a|a

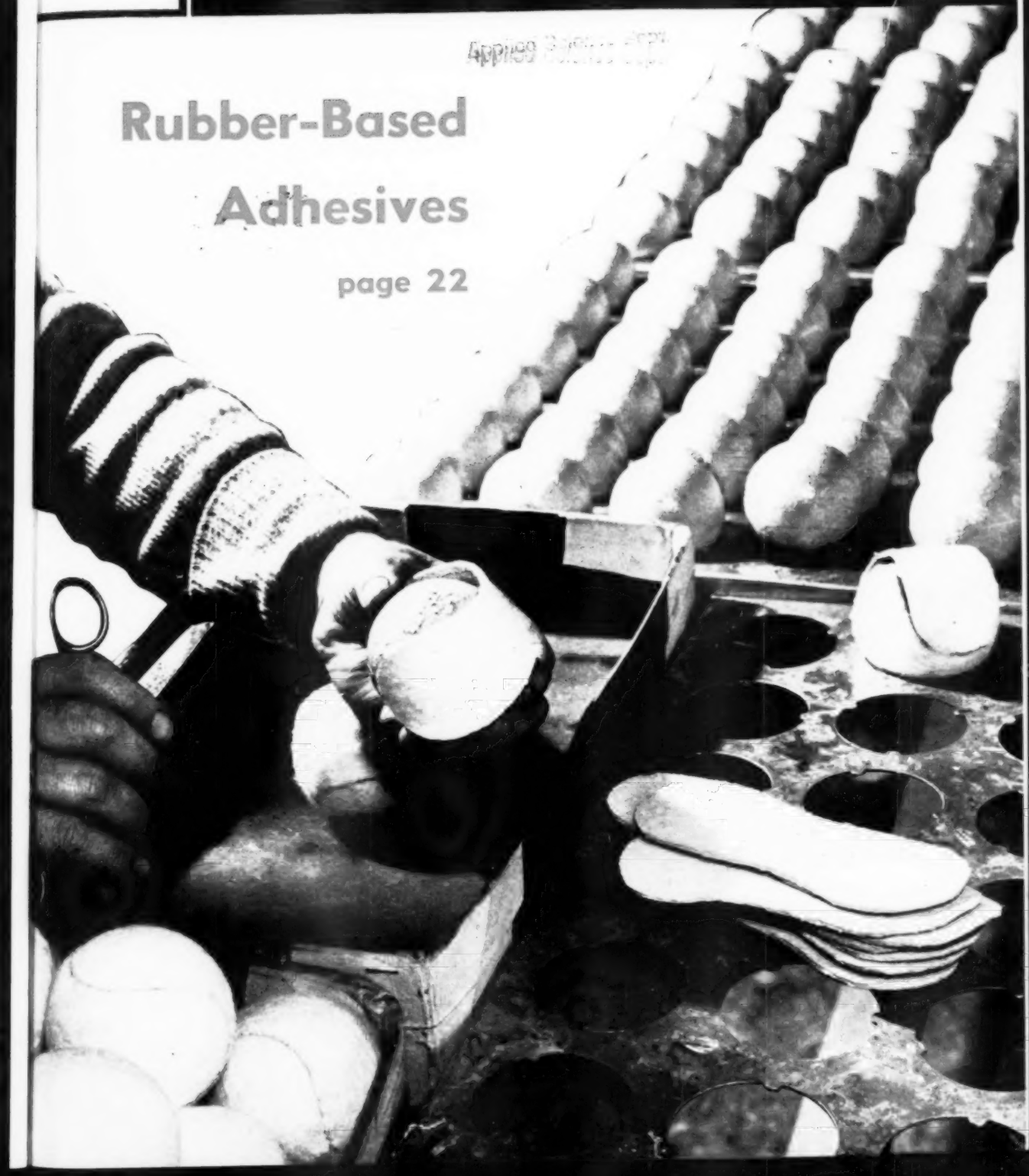
NOVEMBER, 1959

ADHESIVES AGE

Applied Science Dept.

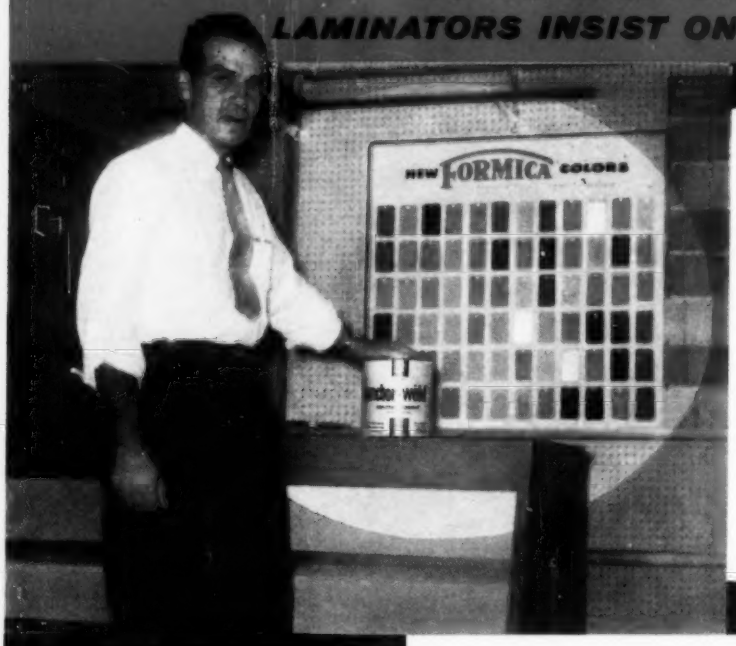
Rubber-Based Adhesives

page 22



more proof that anchor-weld is a superior contact cement!

NO WONDER TOP LAMINATORS INSIST ON anchor-weld



"Stove fixtures are made to take a lot of abuse and hard wear. It's important that their plastic laminate surfaces be firmly and permanently bonded. That's why we use Roberts ANCHOR-WELD *contact bond cement exclusively."*

Robert E. Funke
Dayton Showcase Co.
Dayton, Ohio

prove it yourself!

Row of dominoes coated with **anchor-weld**

Ten minutes later toppled over

1 second later tightly bonded

anchor-weld CONTACT CEMENT *bonds fast... bonds strong... bonds permanently!*

INSTANT BOND AFTER MINIMUM SETUP

Brush, trowel, or spray both surfaces...wait 10 minutes. Position carefully, and watch it grab! *(Will also stay "open" up to 6 hours if necessary.)*

FIRM, DURABLE BOND — Elastic, shock-proof. Surpasses the requirements of the most rugged professional use! Ensures 100% customer satisfaction.

PERMANENT — Strength increases with age. Waterproof. Wide temperature range: up to 180° and down to --40°.

...YET COSTS SO MUCH LESS TO USE

19% less per square foot than closest competitive brand—as much as 45% less than other brands.

better bond with **anchor-weld**

ROBERTS

Send for free prove-it-yourself sample today!

Write Dept. No. AA-119

THE ROBERTS CO.

600 North Baldwin Park Boulevard • City of Industry, Calif.
In Canada write: 46 Racine Road, Rexdale, Ontario

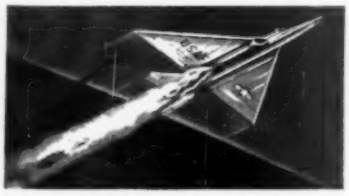
HIGH TEMPERATURE SEALANTS

STABOND by American Latex...

...protect against flame and excessive temperatures

The highly successful "HT" series of STABOND compounds has proven to be the dependable *high temperature* sealant that will withstand any calculated or emergency temperature range. Accepted and widely used in the aircraft, insulation and hot air ducting fields, the versatile STABOND "HT" series is adaptable to a multitude of specific applications, providing such outstanding features as:

1. Lighter weight and greater flame resistance than stainless steel.
2. A sheath sufficiently flexible to withstand the vibration of aircraft engines, rocket motors, etc.
3. They may be "tailored" to fit any given contour in any location.
4. Ease of application and handling.



Withstanding such emergency temperatures as a near disastrous engine fire, STABOND "HT" sealants prevented fire access to the entire aircraft, averting the loss of life and valuable property.

STABOND Sealants and Adhesives are manufactured to a wide range of government and aircraft specifications.

	Temperature Limits	Consistency
HT-1	−65° to 300°F Continuous plus 1500°F Intermittent	Paste
HT-2	−65° to 350°F Continuous plus 2800°F Intermittent	Paste
HT-3	−65° to 550°F Continuous plus 3000°F Intermittent	Putty
HT-4	−65° to 500°F Continuous plus 1750°F Intermittent	Putty
HT-5	−80° to 600°F Continuous plus 2500°F Intermittent	Paste
HT-12	−65° to 300°F Continuous plus 1500°F Intermittent	Heavy dough-like
HT-13	−65° to 350°F Continuous plus 2800°F Intermittent	Heavy dough-like
HT-23	−60° to 350°F Continuous plus 1800°F Intermittent	Heavy dough-like

AMERICAN LATEX
PRODUCTS CORPORATION
3341 W. El Segundo Blvd., Hawthorne, Calif.
ORegon 8-5021 • OSborne 6-0141
A Division of The Dayton Rubber Company

STABOND

ADHESIVES
COATINGS
SEALANTS

A complete research and development staff and facility is available for determining new applications. Please call or write for additional and/or technical STABOND *information.*

BRANCHES: San Francisco, 42 Gough St. Seattle, 2231 5th Ave. Dallas, 1300 Crampton St. Houston, 401 Velasco. Omaha, 3304 N. 48th St.

how to
"PEEL"
residue glue from a coating tank...

apply
RELEASE-COTE
the miracle
RELEASING AGENT

With just a thin film of RELEASE-COTE on tank surfaces, glue and adhesives peel "like skin off a banana."

FREE
TRY OUT OFFER!
A generous sample of RELEASE-COTE for you to test. (Note how operators like Release-Cote's gentleness to their hands).

Distributed by
POTDEVIN MACHINE CO.
297 North Street, Teterboro, N. J.
World's largest producer of coating machines.

ADHESIVES AGE

AA

In This Issue

Versatile Rubber-Based Adhesives—
By H. J. Northeast
A review of the manufacturing processes and the industrtial applications of adhesives based on natural rubber in both the form of latex and as a solid dissolved in organic solvents 22

Epoxies Help Slenderize TV Waistline
The use of epoxies to laminate contoured implosion panels to the face of TV tubes opens up an important new market for the adhesives manufacturer 25

Increasing Adhesive Strength with Fine Size Silicas
—By L. O. Young
Tests made on representative adhesive formulations show that in some cases bond strength can be increased by as much as 50 per cent by the judicious addition of silicas 26

Adhesive-Bonded Jet Aircraft Wings
By strengthening and sealing the wings of its "880" transport plane with a nitrile phenolic film, Convair gains additional fuel storage space required by the aircraft's high speed 28

Combining Vinyl and Cloth—
By Robert S. Brookman
Adhesives and techniques for laminating vinyl to cloth are opening up new commercial applications for vinyl by making possible new design combinations 30

About the Cover Photograph

This month's cover photograph is a close-up view of the production line technique used for affixing covers to tennis balls coated with a rubber-based solution adhesive. A survey of the manufacturer and application of rubber-based adhesives is given in the article beginning on page 22.

The opinions expressed by authors and contributors to ADHESIVES AGE are not necessarily those of the editors or publisher. Articles appearing in ADHESIVES AGE may not be reproduced in whole or in part without the express permission of the publisher.

PALMERTON PUBLISHING CO., INC.

NOVEMBER, 1959

VOL. 2 NO. 11

Laying Down the Line
New York City's Department of Traffic is now using vinyl plastic ribbon bonded with rubber-resin adhesive to lay out cross-walk markings in midtown 33

Automotive Adhesives
New adhesives and bonding methods solve the problem of butt joining automotive weatherstripping so that it successfully passes various "torture" tests. 34

Adhesives for Prostheses
Skin adhesives used to attach artificial limbs or features to the human body must meet a variety of special requirements 36

Eliminate Solvent Hazards
The second and concluding portion of this survey deals with methods of ensuring against dangers of dermatitis and fire by setting up proper plant operating conditions 39

Coming Next Month

Bonding Reinforced Plastics
Some of the practical aspects of adhesive bonding discussed include measuring, mixing and applying the adhesive

Transporting Liquid Adhesives
Borden Chemical Co. plants in the northwest are now using 300-gallon all-aluminum containers to make bulk shipments of liquid adhesives

Adhesion—Cohesion and Corrosion
A study of the corrosion of materials under diverse conditions provides some interesting clues to the understanding of adhesion

DEPARTMENTS

Book Reviews	62	Names in the News	52
Capitol Clues	14	New Adhesives	10
Classified Advertisements	65	New Equipment	60
Coming Events	52	News of the Industry	41
Consulant's Corner	8	Noted in Passing	66
Editorial	7	On the Continent	18
Patent Review	56		

Indexed in Industrial Arts Index and Engineering Index.

© Palmerton Publishing Co., Inc., 1959

10,650 Copies of This Issue Printed

ADHESIVES AGE is published monthly by the Palmerton Publishing Co., Inc. Printing Office, Bristol, Conn. Editorial and Advertising Office at 101 West 31st Street, New York 1, N.Y. Subscription in the United States, $5.00 a year; Canada, $5.50; Foreign $6.00; Single Copy, 50¢. November, 1959. Volume 2, Number 11.

LOGICAL FIRST CHOICE

DARLING'S

improved BONE GLUE

BECAUSE OF

WIDE GRAM RANGE

One of these seven grades should do your job

GREEN STRIPE.....196-220 grams
ORANGE STRIPE.....171-195 grams
ORANGE STRIPE.....146-170 grams
RED STRIPE.....121-145 grams
RED STRIPE.....101-120 grams
RED STRIPE.....81-100 grams
BLACK STRIPE.....30-80 grams

HIGHER VISCOSITY

Compared to other types of animal glue of equal gel test

CONSISTENT QUALITY

Thanks to volume production under constant technical control

ASSURED SUPPLY

Darling's location in Chicago, the heart of the meat industry, provides a steady supply of raw material

BASIC LOW COST

From a rapid, efficient manufacturing process and a relatively inexpensive raw material

NOW AVAILABLE!—a new, light color, extra quality glue, testing 60-70 and 80-90 grams—
DARLING'S GOLD STRIPE

For samples, technical information, prices—write or call YArds 7-3000.

DARLING & COMPANY
GLUE DIVISION
4201 South Ashland Avenue
Chicago 9, Illinois

Improve product performance, cut costs with 3M Adhesives, Coatings and Sealers

VIBRATION RESISTANT. Tough aluminum strips (bonded in the middle, above) tear before EC-801 bond separates! This versatile sealer is especially suited for integral fuel tanks, keeps them tightly sealed in spite of vibration and flexing. Highly resistant to aircraft fuels; adheres firmly to metals at temperatures from—65°F. to 180°F.

MOISTURE RESISTANT. EC-1300 grips like a bear while wet, speeds rubber-to-metal bonding. Synthetic rubber base has light color for less clean up. EC-1300 sets fast, bonds tightly with no cold flow under pressure. Bonds foam, sponge, extruded and mechanical rubbers fast with moisture-resistant, flexible film.

FIRE RESISTANT. This Bunsen burner can't ignite wet, adhesive EC-321—proof this adhesive can safely be used anywhere on the assembly line. Ideal for bonding sound deadening pads, insulation butts and lightweight padding. High wet strength allows production to continue as adhesive dries. Apply with spray gun, brush or roller.

CORROSION RESISTANT. Rugged torture test! 2000 hours exposure to salt spray; 20 weeks submersion in 20% solution of hydrochloric acid; six-month weather exposure in Miami, Florida proved CORO-GARD® 1706 Brand Protective Coating resists abrasion and corrosion. For steel, aluminum, wood, concrete, cloth and some plastics.

"Coro-Gard" is a reg. TM of 3M Co.

SEE WHAT 3M ADHESIVES CAN DO FOR YOU! Look to 3M with your next adhesive, coating or sealer problem. Call your 3M Field Engineer. Or, for more information and free literature, write to: AC&S Division, 3M, Dept. SAY-119, 900 Bush Avenue, St. Paul 6, Minnesota.

ADHESIVES, COATINGS AND SEALERS DIVISION

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

Published Monthly by
PALMERTON PUBLISHING CO., INC.
Editorial and Advertising Offices
101 West 31st St., New York 1, N. Y.
Phone: PEnnsylvania 6-6872

P. L. PALMERTON, *President*
M. E. LERNER, *Vice-Pres. & Treas.*
E. D. OSBORN, *Secretary*
CHARLES T. JANSEN, *Asst. Treas.*

PUBLICATION STAFF

Editor and Publisher
M. E. LERNER

Managing Editor
B. J. KOTSHER

Associate Editor
STANLEY HOCHMAN

Assistant Editors
BERNARD M. BERNS
HARVEY FIRESIDE
NANCY T. ROCKWELL

Art Director
KENNETH T. CORELL

Production Manager
BETH IOGHA

Circulation Manager
CONSTANCE SAVAGE

Advertising Sales Manager
CHARLES T. JANSEN

Editorial Advisory Board

JOHN DELMONTE
Furane Plastics
JOHN H. FIELD
B. F. Goodrich Co.
BERNARD GOULD
Rubber and Asbestos Corp.
DALE G. HIGGINS
John Waldron Corp.
JOHN R. HUBBARD
Peter Cooper Corp.
JACOB LICHMAN
Borden Chemical Co.
WALTER C. O'LEARY
Minnesota Mining & Mfg. Co.
FRANK W. REINHART
National Bureau of Standards
ROBERT T. SCHWARTZ
Wright Air Development Center
JOHN E. WARNER
Goodyear Chemical
FRED WEHMER
General Adhesives Co.

EDITORIAL

A/A and the 57 Varieties

We are pleased to note that the article on "Overgrading" published in the October issue of this journal has evoked a considerable amount of reader response. It will be remembered that "overgrading" indicates a situation in which a multiplicity of grades of adhesives has the effect of reducing a manufacturer's profit structure. In this situation, the adhesives manufacturer finds himself producing many, many variations of a single adhesive product in order to meet consumer demand and maintain his competitive position.

Many adhesives manufacturers are now of the opinion that they are beginning to "over-specialize" with concurrent losses in time and money. Consumers of adhesives, on the other hand, rightly feel that they are entitled to the best possible solution to their many vexing problems. Consumers, too, are concerned with time and money, and their demands for adequate adhesives products are not unreasonable.

It seems to us that this problem has three facets. First, the adhesives industry, as a relatively new entity, has been following a course historically followed by many other new industries. Most new industries tend to veer off into several directions at one time. The struggle for competitive position is greater at the outset. With time, however, the situation normally "shakes itself down" into more orderly patterns. Some companies are obviously better suited to handle certain problems than others. It takes time to find this out, however.

Second, there is this matter of technology. Adhesives technology is growing —and growing so rapidly—that an adhesives manufacturer often finds his newly introduced product has already been followed by a newer variety which promises better performance. While some consumers will turn to the newer variety, many consumers will "stick with the old" and so the manufacturer finds himself with two variations where he had one. More importantly, he will, in many cases be unable to determine which is the better of the two.

Third, we come to this matter of the selection of the proper adhesive by the consumer. In our editorial in the March, 1959, issue, we pointed to this situation calling attention to the specific need for specifics to simplify the matter of assessing the problem and selecting the proper adhesive for the job at hand. There is evidence that much adhesive selection is done on a haphazard basis. More adequate definition of the problem will serve to reduce overgrading.

On the face of it, overgrading works to the disadvantage of both manufacturer and consumer. The solution to the problem lies in time and education. We feel that with each passing day, consumers and manufacturers are becoming better acquainted with each other's needs and we further feel that ADHESIVES AGE can play a major role in this educational process.

Regardless of your needs, if you're hand-applying glue... FF equipment can help you do the job better, easier and faster than you ever thought possible. Over 175 Glue Guns give you a complete selection, with each unit fully guaranteed . . . and packed with amazing money-making, money-saving advantages. The perfect answer for strip, spot, groove and hole gluing. Write for catalog.

JOHN P. FOX COMPANY, INC.
1107 S. Mountain • Monrovia, California
Select areas open for agents and distributors

Have you an ADHESIVE PROBLEM?

Dural **has the SOLUTION**

Dural's wide experience and years of research in the "fastening" needs of industry can help you! Write us about your problem — no obligation.

For any type of adhesive, call DURAL first — for lower costs and prompt delivery.

Dural **COMPANY, INC.**
103 West Pierce Street • Milwaukee 4, Wis.

CONSULTANT'S CORNER

By Dr. Irving Skeist

Question: Can you furnish us with the names of a manufacturer to supply a plastic compound for filling the edge of a mitre joint for use under a lacquer finish? The joint must remain closed in normal home temperatures. At present, we find that the joint shows a fine hairline when finished in white lacquer. Due to expansion and contraction, it appears to be unnoticeable for several weeks after being lacquered.

Answer: A formulator of epoxy resins should be contacted. The hairline may be due to migration of plasticizer from the lacquer to the filling compound underneath. A suitable epoxy compound would seal the joint without encouraging plasticizer migration. *Q-120*

Question: I don't share your enthusiasm for the epoxies. We tried using them in our process, and some of the people who worked with the stuff came down with rashes on the hands, elbows and eyes. We've gone back to safer materials.

Answer: Epoxies are safe enough when handled with respect. When there is trouble, the epoxy resin itself is seldom to blame. Dermatitis is usually due to actual body contact with the amines most commonly employed to harden the epoxy resin. Machines are available which meter, mix and dispense the resin-hardener combination automatically. If hand mixing is necessary, the operator can wear rubber gloves, which should be washed after use.

At least two resin manufacturers offer amines which have been modified to make them safer to handle; ask your supplier for "hydroxyethyl amines" or "minimum irritation potential hardeners."

Finally, if you can cure at an elevated tempera-

Readers who would like to contribute their own experience with problems similar to those discussed in Dr. Skeist's column are invited to write to ADHESIVES AGE, *101 West 31st Street, New York 1, New York. Please refer to the code number given at the end of each question and answer group.*

CONSULTANT'S CORNER

ture, you can get away from the amines altogether and switch to acid and anhydride hardeners, which are much less likely to cause skin irritation.

Incidentally, dark-haired and dark-skinned people are much less sensitive to amines than blondes and redheads, and men have less trouble than women.

Q-122

Question: In your August, 1959 issue, the article on page 28 entitled, "Adhesives for Flooring" is very interesting. The article tells how to prepare a concrete floor and to lay the tile on it. We have a problem where the concrete floor was not prepared with the vapor barrier located under the concrete.

Would it be possible to use adhesives such as synthetic rubber latex on top of the concrete floor, then lay a vapor barrier of a flexible vinyl sheet, and then a homogenous vinyl flooring on top of this, using again synthetic rubber latex? The concrete floor is on grade.

Answer: Yes. A nitrile rubber (butadiene/acrylonitrile rubber) will probably be most suitable, either by itself or in combination with a vinyl chloride resin. The rubber and resin will be cheapest and safest to use from latex; but a better bond can be obtained if they are laid on from solution in organic solvents ("dopes" or "cements"). Tell your supplier that the floor is on grade, so that he can incorporate the proper thickeners.

Q-124

Question: We are looking for a chemical medium which will meet the following specifications:

(1) It must be able to be applied to a wood surface prior to the application of a pressure-sensitive, adhesive-backed material.

(2) A later reaction to the mating of this chemical and the pressure-sensitive adhesive material must be to create a permanent bond.

Answer: As I understand the problem, you do not necessarily require both a coating and a pressure-sensitive adhesive, so long as you attain your objective, which is to adhere the "material" to the wood in such a manner that the bond can be either peelable or permanent. If the "material" is cotton or the like, you may get good results with a butadiene/acrylonitrile rubber containing vulcanizing agents. A small percentage of phenolic resin may be included as tackifier, if needed. The bond will be pressure-sensitive at room temperature, but can be cured by raising the temperature.

Q-126

Dr. Skeist is associated with Skeist & Schwarz Laboratories, Inc., 89 Lincoln Park, Newark 2, N.J. He is the author of the recently published book, "Epoxy Resins."

EASY TO APPLY. PLIOBOND requires no mixing, brushes on, dries rapidly.

EXCELLENT ADHESION. PLIOBOND exhibits exceptional strength—up to 1600 lbs./sq. in. in shear tests.

EXTREMELY DURABLE. PLIOBOND resists age, heat, cold, water, chemicals, oils.

Pliobond
BY
GOODYEAR

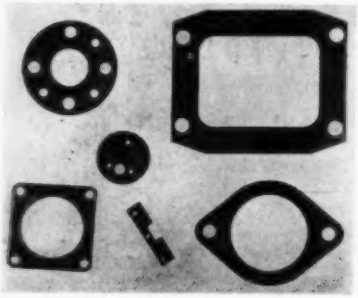
Pliobond—T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

new adhesives

AND ADHESIVE PRODUCTS

Adhesive Pre-Forms

Die-cut or pre-formed shapes of dry adhesive film are now available for many laminating applications. A feature of the new Auburn adhesive is its paper interliner. The 2-mil film



has a visible effective adhesive layer. Optimum application conditions for the dry adhesive film is as follows: glue-line temperature 325°F. to 350° F.; from 100 to 2000 psi; a 10 to 20-minute cure. Uniform heat and lamination pressure is required and surfaces must be free of rust, scale, grease or loosely adhering film. Typical uses of the adhesive film include printed circuit construction and lamination of surfaces such as cold rolled steel, brass, galvanized iron, aluminum, phosphor bronze, chrome steel and phenolic laminate. *Auburn Manufacturing Co.* **P-199**

Synthetic Resin Latex

Designed for use in adhesives, textile printing inks, carpet backing and upholstery backing, Pliolite Latex 140 is a water dispersion of a styrene-butadiene copolymer. At room temperature it forms tough, flexible films with low odor, excellent clarity and adhesion, high pigment binding and mechanical stability, states the manufacturer. High styrene reinforcing latices can be used with Pliolite Latex 140 to improve its physical properties. The product contains a non-staining anti-oxidant system. A sister product, Pliolite Latex 141, is available without an anti-oxidant system for those who prefer their own. *Chemical Division, Goodyear Tire & Rubber Co.* **P-200**

Resin Emulsion

Combining borax tolerance with a high degree of compatibility with organic solvents, Resin D-243 is a new borax stable polyvinyl acetate-dibutyl maleate copolymer emulsion. It is recommended for use in adhesives, in textile finishing, as a cement additive, in paper coatings, surface coatings and as a beater additive in paper manufacture. The product has a particle size distribution of from 0.2-1.5. In addition, the resin is reported to have superior flow characteristics, excellent freeze-thaw and mechanical stability. It can be compounded with defoamers, thickeners, hardeners, tackifiers and other modifying agents in the same manner as other polyvinyl acetate emulsions such as Gelva Emulsion TS-30. *Shawinigan Resins Corp.* **P-201**

Acetate Cement

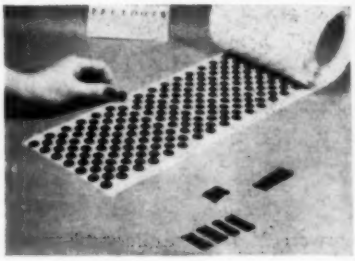
Production hazards in bonding cellulose acetate or butyrate sections are said to be cut by the use of a new acetate cement with a flash point well above 100°F. The product is water white and will not thicken when applied from open containers or felt pads. Its viscosity can be increased by the addition of cellulose acetate shavings. The relatively high flash point and low volatility eliminate the need for red labels or special fire department permits. Designated as Schwartz Acetate Cement, it is supplied in quantities of from one quart to 55 gallons. *Schwartz Chemical Co., Inc.* **P-202**

Latex Backing

Curing at low temperatures, Maniflex 500 is a clear latex film used for backing high pile knit goods. It can be applied by roller or spray, and is both non-toxic and non-flammable. The film is resistant to both laundering and dry cleaning and will prevent ravelling of knit goods due to cutting and handling. The suggested application rate is ¾ to one ounce per linear yard of 54-inch knit goods. *Manufacturers Chemicals Co., Inc.* **P-203**

Adhesive Felt

Feltdots, Feltape and Feltabs are available for cushioning, silencing, insulating and dustproofing applications. Made of high quality wool felt, the products have a pressure sensitive adhesive backing that sticks to any surface, states the manufacturer. In ⅛-inch thickness, the material is available in brown, white, taupe and gray; mothproofed it is available in brown, gray and taupe. In 3/64-inch thicknesses the colors are brown, white, green, beige and black; mothproofed in brown only. The



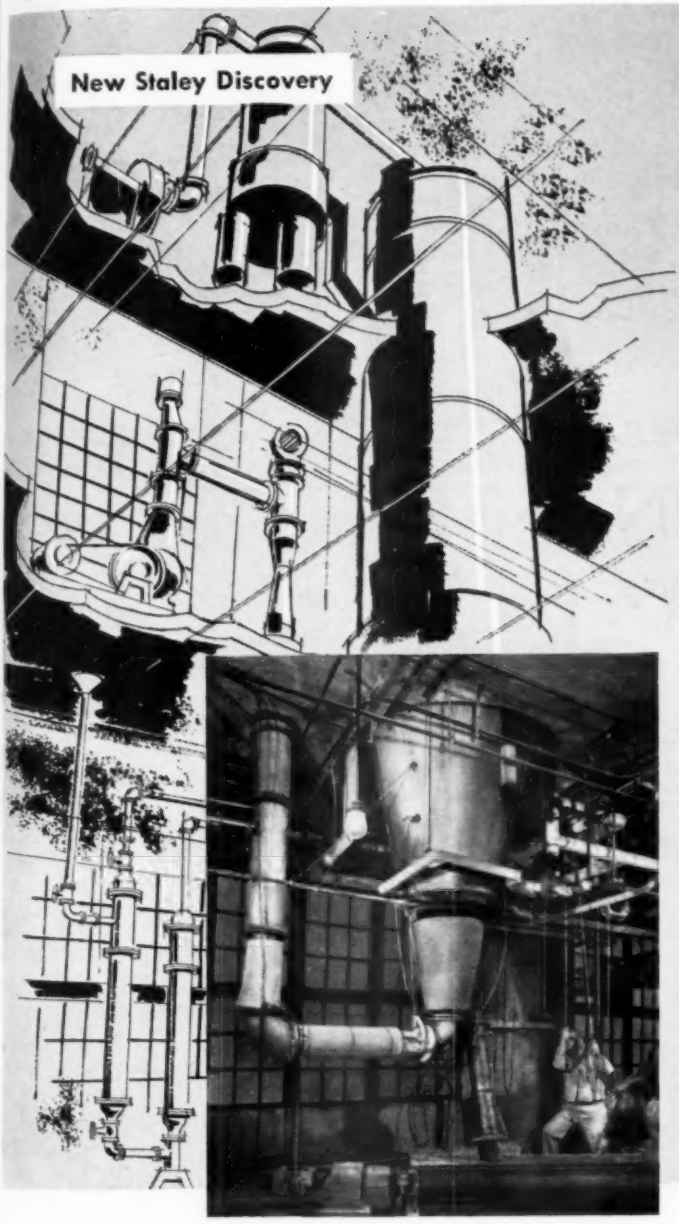
dots and washers range from ¼-inch to one-inch diameter; the tape is ⅛ to two inches wide; the tabs are from 9/32 inch square to 3/16 x 1 3/16 inches. Special sizes and shapes on order. *J. B. Dawn Products.* **P-204**

Bleeder Cloth

The functions of a parting agent (such as cellophane polyvinyl alcohol, silicone or wax) and a bleeder cloth are combined in Ventcloth. The product consists of a woven glass fabric impregnated with an efficient parting agent. It is used in vacuum-bag molding operations wherever a large laminate area is being cured and there is a chance that the vacuum will not draw all of the air across the entire surface. After the resin has cured, the Ventcloth layer can be easily stripped from the laminate surface. The fine weave of the fabric is said to result in a smooth laminate surface that requires a minimum of finishing. The cloth will also prevent the vacuum bag from adhering to any adhesive that is exposed beyond the bond area. *Narmco Resins & Coatings Co.* **P-205**

Contact Adhesive

The delayed tack, bonding strength, water resistance, flexibility and spreading properties of Plastitak Contact Adhesive F 188G are said to recommend it for applica-



Giant pressure chamber, 3 stories tall, transforms dry starch into flying missiles . . . bombards each particle with an even distribution of heat to produce new

Stadex® DEXTRINS

OF UNSURPASSED UNIFORMITY

•

GREATER DEPENDABILITY

•

MINIMUM COLOR

Yes—you can always depend on Stadex Dextrins for the same fine results every time. From bag to bag, carload to carload, Stadex Dextrins give you a new high degree of uniformity never before possible in a dextrin.

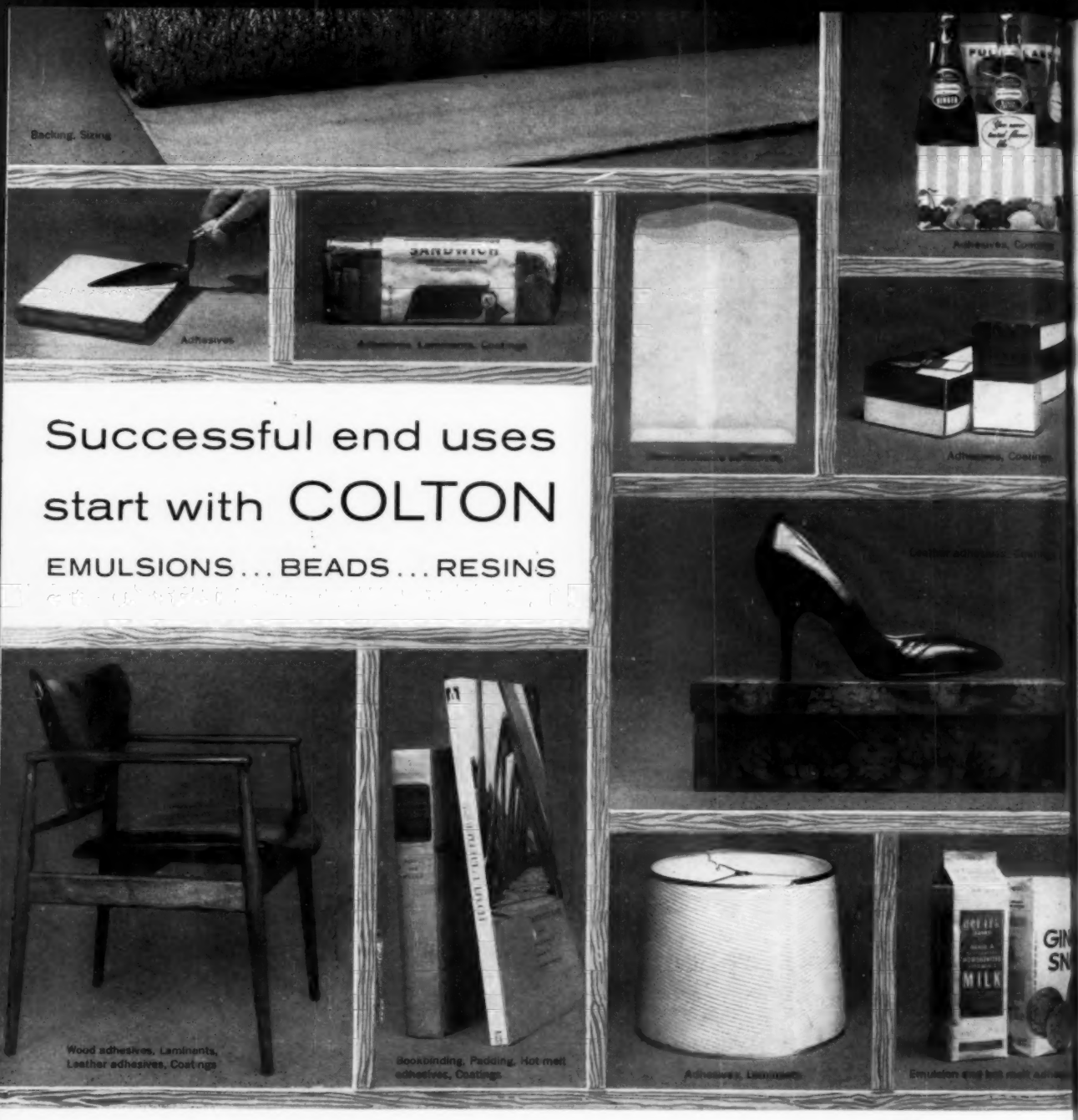
Thanks to Staley's patented new "fluidizer" process that eliminates dextrinization variables, Stadex Dextrins give better adhesion . . . possess unsurpassed quality and dependability. And most important, Stadex Dextrins are "cleaner" . . . with new, lighter color and *no overcooked particles.*

Available in a wide range of viscosities in whites, canaries and British Gums, Stadex Dextrins are tailor-made to meet your most exacting requirements. Why not investigate the definite advantages Stadex Dextrins can bring to your operation. For further information, see your Staley Representatative or write:

A. E. STALEY MFG. CO., DECATUR, ILL.

Branch Offices: Atlanta • Boston • Chicago • Cleveland • Kansas City
New York • Philadelphia • San Francisco • St. Louis

Stadex® DEXTRINS



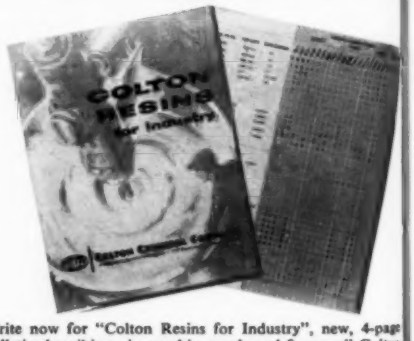
Successful end uses start with COLTON

EMULSIONS . . . BEADS . . . RESINS

The right adhesive helps any product on the road to market success . . . and for adhesive manufacturers success can start with Colton emulsions, beads, and resins.

Colton offers a wide range of products, each available in a variety of grades, each tailored to meet specific formulation requirements. Colton supplies resins for adhesive compounding . . . not finished adhesives.

Vinac (polyvinyl acetate homopolymer emulsions, beads and spray dried powder), Flexbond (copolymer emulsions and beads), and Vinyl (polyvinyl alcohol) give formulators a choice of starting points for adhesives to suit specific end-uses. By starting with Vinac, Flexbond, or Vinol products you eliminate guesswork and needless production worry because Colton polymers meet high specifications. Colton starts with high quality monomers . . . production is controlled and strengthened every step of the way by Colton's years of knowledge and continuous research . . . and backing up the skills of Colton Chemical Company, a division of Air Reduction Co., Incorporated, are the basic research resources of Airco's Central Research Laboratories at Murray Hill, New Jersey.



Write now for "Colton Resins for Industry", new, 4-page bulletin describing—in graphic, condensed form—all Colton products developed for adhesive formulations . . . or call for Colton technical service.

COLTON

COLTON CHEMICAL COMPANY

A Division of Air Reduction Company, Incorporated • 1747 Chester Avenue, Cleveland 14, Ohio

Sales Offices and Warehouse Facilities Throughout U. S. • Export: Airco Company, International, New York 17, N.Y.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .

AIR REDUCTION PRODUCTS

tions such as the installation of table tops and wall panels. It can be used to combine Formica, plywood, fiberglass, cotton, cloth, metal, concrete, ceramics, plastics, and foam rubber. It can be folded on itself without cracking. Both surfaces to be bonded are coated with either a brush or a notched trowel. Before actual bonding, the adhesive should be allowed to dry until tacky. Open tack time at room temperature is from 15 to 60 minutes depending on local conditions. *Gordon Lacey Chemical Products Co.* **P-206**

Aluminum Filled Formulation

Thixotropic and room-temperature curing, RCM Adhesive 107 is an aluminum filled formulation developed for bonding metals, glass, ceramics and wood. Special features include low shrinkage on cure and resistance to thermal and mechanical shock as well as chemicals and weathering. It has a pot life of 75 minutes after the mixing of the hardener into the resin system. The system is non-toxic. The tensile strength of the adhesive is 3400 psi at room temperature; its peel strength is from 15 to 20 pounds. *Resin Consultants & Mfg.* **P-207**

Synthetic Fabric Bondant

Permanent bonding of either vinyl plastisol or film to various synthetic fabrics is possible with a new adhesive system involving the application of a vinyl solution containing dianisidine diisocyanate to the fabric by normal coating methods. Vinyl plastisols or films are then applied to the fabric primed in this manner. The 10 to 30-pound bond obtained can be varied to suit cold flexibility, tear strength, elevated temperature properties, etc. Systems containing dianisidine diisocyanate are said to be remarkably stable in both solution form and as applied. *Carwin Co.* **P-208**

Bookbinding Adhesive

A new series of plasticized vinyl bookbinding adhesives is available for use on a wide variety of book cover stocks in casing-in operations. Designated as Cascorez adhesives, the new products are an extension of the manufacturers line of packaging and paper adhesives which are said to utilize a unique penetrant system. The adhesives will be sold in 55-gallon drum quantities. *Resins and Chemicals Department, Borden Chemical Co.* **P-209**

Paper Coating Latex

Dylex Latex KCD-154 is a new latex for pigmented paper coatings. Improvements over conventional styrene-butadiene latices are said to have been obtained by adjusting the emulsifier content and fortifying the polymer during polymerization. A 50 per cent increase in film strength is claimed and the foaming tendencies of the latex are reported to be considerably decreased. KCD-154 can be used alone or with either starch or protein. Films cast from this latex are smooth, tough and exhibit a high degree of resistance to water. They are clear to slightly hazy. *Plastics Division, Koppers Co., Inc.* **P-210**

Caulking Compound

Based on DuPont's Hypalon, chlorosulfonated polyethylene, Maintz Architectural Caulking Compound can be applied by gun or knife. It cures into a resilient, rubber-like material. It is a one-part curing system and is used directly from the container without further mixing. The compound is available in white and a variety of fast colors. No priming or other special surface preparation is necessary. *West Chester Chemical Co.* **P-211**

Polysulfide Sealants

3C sealants for the construction industry are two-part synthetic rubber compounds of the polysulfide type. Mixed together they cure at room temperature and are resistant to weather, corrosion, moisture, salt water, oils, fuels, and high or low temperatures. Their ability to expand and contract makes them especially suitable for sealing structures and joints. They are available in different consistencies such as brush type for protective coating application, pourable for sealing horizontal joints and seams, and non-sagging for sealing vertical joints, window sealing and curtain wall construction. *Can-Tite Rubber Corp.* **P-212**

Structural Adhesives

Lefkoweld structural adhesives are of the two-component, paste type for use in bonding metal, ceramics, glass, hard rubber and most plastics. They may be cured at room or slightly elevated temperatures with only contact pressure necessary. Lefkoweld 46, 108 and 201 are especially useful in high-strength metal bonding, but can be employed in cementing other materials to themselves and each other. Types 108 and 201 are designed for curing at moderately elevated temperatures. They meet U.S. Government Specification MIL-A-5090B which covers organic resin adhesives for use in bonding metal airframe structural parts. *Leffingwell Chemical Co.* **P-213**

Steel Tile Adhesive

Formulated especially for the dairy industry, C-560 steel tile adhesive is said to be suited for most other manufacturing segments of the food processing industry. It bonds the metal tiles to sub-floor surfaces such as concrete and terrazzo. The adhesive material resists lactic acid, grease and fat attack. It is a two-part product consisting of a basic resin compound and a separate hardener. The blended components are applied to the sub-floor by notched trowel and the steel tile installed immediately afterwards. Setting time to full strength is 24 hours or less. *Coatings and Adhesives Department, Borden Chemical Co.* **P-214**

Pipe-Wrapping Tape

The advantages of a heavy mastic layer of butyl combined with a tough outer cover of vinyl are claimed for Warco Laminated Tape. A specially formulated butyl compound provides a permanent seal which fills all pits and prevents moisture migration at the overlap. The tape is supplied with a primer which prepares the pipe surface for maximum bond strength. It can be applied either by hand or machine and is available in a wide range of thicknesses and widths. *West American Rubber Co.* **P-215**

FOR MORE INFORMATION on the new adhesives described in these columns, use the Reader's Service Card elsewhere in this issue.

capitol cues

BUSINESS WILL SNAP BACK FAST THIS FALL, aided by renewed steel output. With the mills again operating, economists see nagging doubts disappearing. The stock market will make new gains, industry and consumers will be buying again at a fast clip, and corporate profits will once more be on the increase. The fourth quarter will show gains as large as those during 1959's first half.

The main reasons for the business strength this Fall:

- Inventory accumulation will be rising again, though buying will trail the first half's $10 billion-a-year pace. Tight money will tend to depress the rate at which firms can buy.
- Business investment is rising and will continue to increase. Corporations now have—or can get—much of the money they'll need; but work on offices and shopping centers may slow down.
- Consumer durables will gain in sales, as incomes climb and optimism rises. Interest charges are going up but tighter money won't crimp instalment sales until 1960, if by then.
- Public construction will be expanding, despite tight money. Housing activity won't feel the credit pinch till next year.
- U.S. exports will rise as world-wide business is stepped up.

Here are figures on the size of the upturn economists see:

- Industrial output will rise 6% or 7% to a brand-new record.
- Employment will rise to around 66.5 million during December, 2.5 million over a year ago. Unemployment won't change much.
- Retail sales will be rising 7% to 8% over last year. Autos will set the pace in the fourth quarter with a 40% increase.
- Gross National Product—total output of goods and services—will rise 11% from a year ago and some 2½% from today's rate.

A NEW PROFITS RECORD IS LIKELY THIS YEAR, despite the steel strike. During the first half, profits were running at a yearly rate of $49 billion. In the second half, the rate may drop a bit, though there will be a rebound in the last three months. (The steel strike was a drag during the Summer.) As a result, total 1959 profits may come to only around $48 to $49 billion.

Such a showing, even though it is a bit below early guesses, will still be very good. Previous peak for corporate profits was the $45 billion total in 1955. A good comeback this Fall raises the possibility of more gains in profits during 1960.

MORE FIRMS WILL BE ASKING FOR GOVERNMENT LOANS this Fall—that's the expectation of U.S. officials. Tight money will force hard-pressed outfits to go to the Small Business Administration and SBA-authorized Small Business Investment Companies. From SBA, loans can be obtained at better than going-market rates of 5½%. Private lenders participating can charge up to 6½%.

From the SBIC's, there is around $13.5 million available at 30 chartered "banks." But interest rates are much higher—10% to 15%—since loans are backed only by borrowers' bonds.

Nov. 2-4. Atomic Industrial Forum, 1959 Annual Conference, Sheraton Park Hotel, Washington, D.C.

Nov. 2-6. 41st National Metal Exposition & Congress, American Society for Metals, International Amphitheatre, Chicago, Ill.

Nov. 2-6. Society for Nondestructive Testing, 19th Annual Convention, Hotel Hamilton, Chicago, Ill.

Nov. 4-6. Society of Rheology, Lehigh University, Bethlehem, Penna.

Nov. 5-6. ASTM, Committee D-14 on Adhesives, Case Institute of Technology, Cleveland, Ohio.

Nov. 8-13. International Rubber Conference, sponsored jointly by Division of Rubber Chemistry, ACS; Committee D-11, ASTM; Rubber and Plastics Division ASME, Shoreham Hotel, Washington, D.C.

Nov. 12-13. National Industrial Research Conference, Armour Research Foundation, Hotel Sherman, Chicago, Ill.

Nov. 12-14. National Association of Lumber Manufacturers, Annual Meeting, Washington, D.C.

Nov. 16-18. 46th National Foreign Trade Convention, Waldorf-Astoria Hotel, New York, N.Y.

Nov. 16-18. 21st Annual National Packaging Forum, Packaging Institute, Statler Hotel, New York, N.Y.

Nov. 16-19. Building Research Institute, Fall Conferences, Shoreham Hotel, Washington, D.C.

Nov. 16-20. American Rocket Society, 14th Annual Meeting, Washington, D.C.

Nov. 16-20. 5th International Automation Congress and Exposition, New York Trade Show Building, New York, N.Y.

Nov. 17-20. Packaging Machinery Manufacturers Institute Show of 1959 and Annual Forum, New York Coliseum and Statler Hotel, New York, N.Y.

Nov. 19. Symposium on Adhesion and Adhesives in Industry, Sponsored by Quantum, Inc., Wallingford, Conn.

Nov. 19. Society of Plastics Engineers, Technical Conference on Plastics in Packaging, San Francisco, Calif.

Nov. 19-20. Plastics Institute, Conference on the Influence of Plastics in Building, Royal Institute of British Architects, London, England.

Nov. 24. Manufacturing Chemists' Association, 9th Semi-Annual Midwinter Meeting, Hotel Statler, New York, N.Y.

Nov. 30-Dec. 4. 27th Exposition of Chemical Industries, New York Coliseum, New York, N.Y.

Dec. 6-10. American Institute of Chemical Engineers, Annual Meeting, Sheraton Palace Hotel, San Francisco, Calif.

Dec. 7-9. Chemical Specialties Manufacturers Association, 46th Annual Meeting, Mayflower Hotel, Washington, D.C.

Jan. 12-15, 1960. 16th Annual Technical Conference, Society of Plastics Engineers, Conrad Hilton Hotel, Chicago, Ill.

Jan. 26-27, 1960. Society of Vacuum Coaters, Technical Conference, New York, N.Y.

Feb. 2-4, 1960. 15th Reinforced Plastics Division Conference, Society of the Plastics Industry, Edgewater Beach Hotel, Chicago, Ill.

Feb. 14-18, 1960. Hobby Industry Association, American Trade Show & Convention, Sherman Hotel, Chicago, Ill.

Marco Petronio

Portrait Of

MARCO PETRONIO

Chief of the Fluids and Lubricants Section in the Research Division of Frankford Arsenal's Chemistry Research Laboratory, Marco Petronio is in charge of research and development in the fields of adhesives, sealing materials and lubricants.

Some of his organization's current projects include (1) optical adhesives and adhesion of metal, glass and plastic surfaces, (2) sealing materials for use in a variety of military systems, particularly studying the compatibility of materials with missile fuels and oxidizers for use over a temperature range of −300° to 700°F., and (3) basic friction and wear research to provide data for the operation of Ordnance equipment under extreme conditions.

As current chairman of the subcommittee on specifications of ASTM's Committee D-14 on Adhesives, Mr. Petronio has participated in the preparation of several recommended practices and methods. He is also the author of several technical papers on adhesives and related subjects, and has participated in special symposia on adhesives sponsored by governmental agencies and technical societies.

Mr. Petronio received his bachelor's degree in chemical engineering from New York's City College, and did postgraduate work at Brooklyn Polytechnical Institute.

capitol cues (con't)

THERE'S LITTLE CHANCE OF A TAX CUT IN 1960—that's the word now from the Treasury and leaders of Congress. In the current fiscal year, there won't be much of a Budget surplus, if any. And in the coming fiscal year, the prospect is for no more than a surplus of $1 billion or so. That won't be enough to permit relief for individuals. Anyway, if business stays good, Congress won't be under pressure to cut, though 1960 is an election year.

> However, if there should be a downturn—or even a leveling—in the trend of business, you can look for a big campaign by the Democrats for tax relief. But the Administration can be expected to try to put off any reductions for individuals.

THE PENTAGON WILL BUY FEWER DEFENSE ITEMS next year, according to key Budget officials. The military budget now under preparation will call for spending of $41 billion, the same as for the current year. But higher costs in the coming year will mean that the total won't stretch as far as planned. Some projects will be cut out entirely, while others will be trimmed sharply. The number of men in uniform will be reduced, with the big money concentrated on a few important missiles such as the Atlas, Minuteman, and the Polaris.

WHEN CAN YOU BE TAXED ON YOUR INTERSTATE BUSINESS by other states? As you may have read, Congress before quitting voted a law designed to clear this up. You need not pay state taxes hereafter if you only solicit through salesmen whose orders are approved and sent in from out of state, or if your orders are handled through independent contractors. But you may have to pay state taxes if you maintain a warehouse, a sales office, or a stock of goods.

FREIGHT COSTS WILL BE LOWERED ON MANY COMMODITIES in the months ahead. The Interstate Commerce Commission has just formulated a new policy on rates. ICC will hereafter let carriers cut tariffs even if their competitors suffer. So, the railroads will now start cutting charges on long lists of commodities in an effort to regain traffic they have previously lost to trucks and barges.

> This Fall, shippers will be hampered by freight-car shortages. Need for the cars will climb in the wake of the steel strike. Cars even now are in short supply and will get much scarcer.

GROUP MEDICAL INSURANCE COSTS WILL SPURT AGAIN during the next year or so—a fact of considerable importance to employers who help to pay for this fringe benefit. There are two reasons for this trend: Hospital fees and drug prices are going up; and folks are using these benefits more and more. How much will charges rise? 6-8%, as against a 5% average in recent years.

A NEW DRIVE TO BOOST U.S. EXPORTS is quietly being launched by the government in Washington. Efforts are centering in talks with officials of more than a dozen countries—those which have benefited most from economic aid since the war. The action comes at this time because their recoveries are now complete. In fact, most have favorable trade balances with the U.S.

> American officials are plugging for two main things:
> •<u>Reductions in quotas</u> on the importation of U.S. goods—or even their elimination. Foreign economies can stand this.
> •<u>Stepped-up spending</u> of U.S. aid dollars in this country. Right now, recipients are free to buy where they please.

THIS MUCH BUYS ONE POUND OF VINSOL*

In a day of increasing cost, Vinsol resin still remains constant in price—one of the few things that can still be bought for five cents.

Here are the facts you'll want to know about Vinsol:

- a high-melting thermoplastic.
- saponifiable by alkali to form soaps.
- reactive with aldehydes to form resins.
- dark colored, friable.
- substantially insoluble in aliphatic hydrocarbons.
- compatible with a wide range of resins and plasticizers.

Typical Properties

Melting Point (ring and ball)	112°C.
Acid Number	94
Gasoline Insoluble	83%
Oxygen Absorption	0.25%

Available in lump, flake, pulverized, and emulsion forms—as well as powdered sodium soap—Vinsol is finding ever-increasing use in industry. Further technical data is available from Hercules.

In Carloads, f.o.b. Plant

VINSOL®

Pine Chemicals Division, Naval Stores Department
HERCULES POWDER COMPANY
INCORPORATED
900 Market Street, Wilmington 99, Delaware

NVS9-2

• Household repairs offer a tremendous market for adhesives. Housewives and possibly many husbands do not seem to be aware of the greatly extended application of modern adhesives. This point is illustrated by the Women's Editor of *Printer's Ink*, who discusses, in a recent issue, some of the many complaints concerning plastics. (Possibly adhesives offer a solution to the problems cited.)

Headlining her complaints "Plastic Peeves," Dorothy Diamond writes: "Ever since manufacturers have been using plastics on big-ticket items, women have been complaining about them. For instance, I have been told that on an oversized refrigerator, which cost between $300 and $400 several years ago, the tops of the vegetable drawers are made of plastic. When the plastic ends break off (which happens with infuriating regularity), repairs are impossible and my informant has to spend $12 for new drawer tops if she wants to get at the lettuce without resorting to Jimmy Valentine tactics.

"Recently she spent more than $800 on a set of bedroom furniture. The fittings in the top drawers? Plastic again. Not only did they become unglued shortly after purchase but also dropping just a small pair of eyebrow tweezers caused a large piece to chip off. Good question: Why couldn't the manufacturer manage to supply fittings made of wood like the drawers themselves? Conceding that plastics have their place in the modern home, this woman wishes that they would be used with a lot more discretion. Many other housewives, myself included, agree with her."

The adhesives industry could take advantage of this situation. If you buy a piece of fine furniture manufactured in the United States, very often there will be a little leaflet in one of the drawers recommending a certain furniture polish in order to take care of the lustre of the finish. How about a similar notice inserted in those vegetable drawers, recommending a certain adhesive in case the ends break off?

How about a representative contacting hardware stores, variety stores and similar outlets to discuss the expanded possibilities of adhesives and demonstrate their application for mending plastic items, bonding metals, etc.? And how about contacting the furniture industry in order to find out what ails them? Not only should "unglued fittings in the top drawers" be discussed, but also new adhesives for the manufacturing process as a whole.

• The Japanese have been studying the dispersion coating of polytrifluoro-chlorethylene and considerable change of shape has been found to occur in the fused particle during baking. Strongly adhesive coatings are obtained on aluminum and steel pre-treated by grit blasting. The adhesiveness was low on copper alloys unless they had been plated with chromium or nickel.

• Corrosion resistance of flame-sprayed plastics has been investigated in Germany. Sprayed-on PVC and polyamide layers are used as well as pipe-line insulation on variously treated or untreated steel, and on steel flame-sprayed with metal, such as hydronalium and pure aluminum. The corrosive media included sea-water and marine climates, artificial or natural. The PVC and polyamide layers showed good stability, but the pipe-line insulation corroded after a brief period of time. The use of cathodic protection improved the anti-corrosive effect of the sprayed layers.

• Lining metal pipes with a thermoplastic synthetic resin is dealt with in Patent No. 807,413, recently granted to Tubovit Societa per Azioni, Italy. In a process for lining metal pipes with PVC or other thermoplastic synthetic resin, the PVC is first formed into a tube having an outer diameter greater than the inner diameter of the metal pipe. The PVC tube is then heated to a temperature at which it undergoes deformations which may be temporarily set by cooling but are substantially eliminated by subsequent heat treatment. While the tube is hot, it is passed through a die having an inner diameter smaller than the inner diameter of the metal pipe. The PVC tube is then rapidly cooled and passed into the metal pipe, the assembly being subsequently heated to cause the PVC tube to revert to as near to its original diameter as the metal pipe will permit, and so form a tightly fitting lining to the metal pipe.

• A multimillion dollar plant for the manufacture of plastic materials will be built in France jointly by Dow Chemical International Ltd., S.A., and Pechiney, S.A., a leading French chemical and electro-metallurgical concern. The two companies will jointly operate the new factory, managed by a newly formed French company, Plastichimie, S.A. The plant site is located at Ribecourt, near Paris, where Pechiney operates a large polystyrene manufacturing facility which will become a part of the new corporation.

Schenectady Resins increase adhesion, control tack of shoe sole adhesives

Shoe repair and assembly is speeded, handling simplified when Schenectady phenolic resins are used in neoprene shoe sole cements. These resins air-dry rapidly and provide increased strength and heat resistance. They also improve adhesion to many different types of surfaces.

Schenectady manufactures the most complete line of resins for adhesives in the industry. Phenolics, modified-phenolics, terpenes and terpene phenols are available and in commercial use. Whatever your adhesive resin requirement, your Schenectady technical representative is ready to help. Why not call him today or write: Schenectady Varnish Company, Inc., Dept. 191-2, Schenectady 1, N. Y.

PRESSURE-SENSITIVE ADHESIVES made with Schenectady light-colored pure terpene resins, resist oxygen-aging, retain excellent tack and adhesion over long periods.

INDUSTRIAL ADHESIVES made with Schenectady modified-phenolic resins have excellent tack and may be activated at low temperatures.

Synthetic Resins and Varnishes for Industry

SCHENECTADY VARNISH CO., INC.

SCHENECTADY, N. Y.

In Canada:
Schenectady Varnish Canada, Ltd.
309 Comstock Road
Toronto, Ontario

In Mexico:
Schenectady Varnish de Mexico, S. A.
M. Antonio Caso No. 28 1er
Mexico 4, D. F.

On the Continent

Pechiney will also furnish operating staff and will market the products in France. The factory will start operating in 1961.

• *The Catalog of Technical Reports* published by the U. S. Department of Commerce, Office of Technical Services, is a treasure chest of information which every alert research and development department in the adhesives industry should look into. The catalog is a suggested list of references compiled from the 250,000 technical reports made available to industry through the Office of Technical Services. For information write Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. In order to convey an idea of the value of this publication a few of the latest additions to that list are reviewed:

"Investigation of Adhesives: Metal-to-Metal Bonding." The object of the work described in this report was to investigate the use of resinous-type adhesives as replacements or alternates for soft solder in bonding galvanized steel screens to cold-rolled steel shrouds in the tail fin assembly. Tensile tests of the adhesives investigated were compared with soft solder after storage in three climatic conditions, desert, tropical, and arctic.

"Adhesive for Composite Material Used in Printed Circuitry." The purpose is to improve the peel strength between metal foil and various base laminates. The tasks are to produce an improved composite material based on: A) copper foil, paper and phenolic resins; B) copper foil, nylon fabric and phenolic resins; C) copper foil, glass fabric and melamine resins; D) copper foil, glass fabric and silicone resin; E) copper foil, glass fabric and teflon or similar fluorinated resins; F) copper foil, glass fabric and epoxide resins.

"Evaluation with Nylon DV-55 Interlayers." The tensile strengths at 90°C. of these interlayer films, plasticized with 30 per cent benzyl alcohol and cross-linked with 1 per cent salicylic acid, have been as much as 5000 to 7000 psi. Work was done toward the improvement of transparent plastic laminates; polyvinyl butyral was also plasticized with dibutyral sebacate and cross-linked with ethylurea (23 per cent urea and formaldehyde).

• Bonding Rubber to metal and to non-metal is described in two patents which have been granted to the Lord Manufacturing Co. In order to bond rubber to metal, brominated polymerized 2,3-dichlorobutadiene-1,3 is used as an adhesive for bonding natural and synthetic rubbers to metal. The adhesive is applied to the metal surface, a layer of unvulcanized rubber stock is applied to the adhesive-coated metal and then the rubber is vulcanized by heating the assembly under pressure.

In order to bond rubber to non-metals, an adhesive for bonding olefinic rubbers comprises a mixture of an isocyanate and polymerized 2,3-dichlorobutadiene-1,3, or an after-halogenated derivative of this polymer. The adhesive is particularly suitable for bonding olefinic rubbers to polyurethane rubber, the rubbers being vulcanized under heat and pressure after assembling with an intermediate layer of adhesive.

• A program for the development of the Russian chemical industry in the central part of Krasnoyarsk territory during the next 20 to 25 years has been drawn up on the basis of material collected by 50 research institutes of the U. S. S. R. Academy of Sciences. The chemical industry and pulp and paper mills erected in this district will change the industrial pattern of Krasnoyarsk territory which covers 41,700 square miles in Eastern Siberia. Two new hydrolysis factories, synthetic rubber plants and artificial fiber plants are already operating there.

• Thermoplastic polycarbonates are treated in a patent recently granted to Farbenfabriken Bayer AG. Thermoplastic polycarbonates of high molecular weight are made by reacting dihydroxydiaryl ethers or thioethers, optionally mixed with other dihydroxy compounds, with ester-forming derivatives of carbonic acid.

• The leading German newspapers and official reports from a number of German organizations indicate that there is practically no unemployment in West Germany. In fact, quite a number of industries have difficulty maintaining their labor force; in several instances it has been necessary to move some factories out of the congested cities in urban neighborhoods in order to hire additional workers. The same situation is true of clerical personnel and it is interesting to note that many German newspapers carry a large number of want ads. Chemists and technicians in all areas of our industries who are able to speak various languages are offered good opportunities.

Due to the fact that a number of American companies are operating in West Germany, there are excellent opportunities for Americans who want to work in Europe and become acquainted with developments in the European Common Market. Every Sunday, three leading German newspapers and the leading Swiss newspaper carry many advertisements in various languages, mostly English, in which technicians, chemists and other technical personnel are invited to submit their applications.

Why users prefer neoprene adhesives for so many different surfaces

Metals, non-metallics, leather, wood, rubber, fabric—manufacturers are successfully bonding these and many other surfaces with quality adhesives based on Du Pont neoprene synthetic rubber. Here are some of their reasons:

Neoprene adhesives are compatible with a wide range of materials—Because neoprene is an elastomer, its adhesive bonds are flexible. On materials like fabric and leather, they display outstanding flex life; on rigid surfaces, they withstand impact, have good thermal stability . . . can take almost any form of physical abuse.

Neoprene adhesives offer strong, tough, long-lasting bonds—What's more, neoprene adhesive bonds *stay* strong and tough. They offer unmatched *all-around* resistance to heat, aging, oil, grease, solvents, weathering and chemicals.

Neoprene adhesives are versatile . . . easy to use—A solvent or latex type is available—or can be tailor-made—to meet almost any need, including immediate or delayed bond development and high hot bond strength. In addition, both latex and solvent types have good storage stability and can be easily applied by brush, spray or roller.

Neoprene is backed by 25 years of proven performance as an industrial and automotive adhesive. Special neoprene adhesives are now used by manufacturers of shoes, aircraft, furniture and building materials. Ask your supplier about neoprene adhesives or write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. (AA-11), Wilmington 98, Delaware.

Neoprene adhesives can be used to bond these surfaces

BAKELITE TO BAKELITE *	FABRIC TO RUBBER	GLASS TO METAL	METAL TO CERAMICS
BAKELITE TO NEOPRENE	FABRIC TO WOOD	GLASS TO PAPER	METAL TO METAL
BAKELITE TO RUBBER	FORMICA TO PLYWOOD	GLASS TO PLASTICS	METAL TO PLASTICS
CONCRETE TO RUBBER	GLASS TO BAKELITE	GLASS TO RUBBER	METAL TO RUBBER
FABRIC TO FABRIC	GLASS TO CERAMICS	GLASS TO WOOD	METAL TO WOOD
FABRIC TO METAL	GLASS TO FABRIC	LEATHER TO LEATHER	NEOPRENE TO NEOPRENE
FABRIC TO PAPER	GLASS TO FORMICA	LEATHER TO METAL	RUBBER TO RUBBER
FABRIC TO PLASTICS	GLASS TO GLASS	LEATHER TO RUBBER	RUBBER TO CERAMICS

**Reg. T. M. of Union Carbide & Carbon Corp.*

DU PONT
REG. U. S. PAT. OFF.

NEOPRENE ADHESIVES

Better Things for Better Living . . . *through Chemistry*

By H. J. NORTHEAST
Sales Manager
Compositions Division
Dunlop Rubber Co., Ltd.

Formulations and Applications of

Versatile Rubber-Based Adhesives

The unique properties of natural rubber adhesives recommend them for industrial applications ranging from flooring cements to envelope sealants

It has been estimated that as much as 5 per cent of the total world rubber production is used in adhesives. Not only the volume, but the range of rubber-based adhesives has been increasing and a review of their characteristics, manufacture and properties may prove a useful reference guide to the field.

Among the outstanding properties of rubber-based adhesives are flexibility, dry tack, water resistance and versatility. These offer certain production advantages and in many cases are indispensable in view of a product's end-use requirements.

Compared with other adhesives media such as animal glues and urea and phenolic resins, rubber-based adhesives offer outstanding flexibility. Generally, a film of hardened adhesive tends to distribute stresses from one substrate to the other, but a rubber-based adhesive will absorb some of the shock and take up stresses due to differing coefficients of expansion.

Unique Special Feature

Natural rubber has a unique dry tack and adheres readily to many surfaces. By adding resins, this tack can be still further improved and extended. Dry tack has many industrial applications; common examples are self-sealing envelopes, sticking plaster, adhesive tape, etc.

The property of water resistance is self-explanatory. Suffice it to say that where water resistance is vital, as in the fabrication of life rafts, solution adhesives based on natural rubber are invariably employed.

Finally, it should be emphasized that natural rubber is the most universal adhesive base. Because of its versatility it can be employed in formulations and applications as different as the pre-stitch solutions used in leatherwork and the heavy cements used for bonding ceramic tiles to cement rendered surfaces.

Natural rubber is used in adhesives both in the form of latex or as a solid dissolved in organic solvents. Generally speaking, latex-based adhesives are employed where porous surfaces such as textile and paper are to be bonded. Solution adhesives find application where more difficult, frequently non-porous, surfaces are encountered.

A brief discussion of the various types of rubber adhesives will help point up some of the differences in fabrication and application.

Rubber solutions—Milled rubber, either pale crepe or smoked sheet, is dissolved in petroleum solvents to provide adhesives suitable for light assembly work as in the manufacture of footwear and rubberized fabrics. They are also used for rainwear and bonding nitro-cellulose leathercloth to hardboard in automobile trimming. These simple solutions can be applied on a variety of surfaces and when tested on canvas to canvas, bond strengths of up to approximately 12 pounds per inch of width are obtained.

Rubber/resin solutions—The properties of the simple solutions already described can be modified to suit specific requirements. Wood rosin is a common additive which increases the tack. However, at the same time it reduces the cohesive strength and causes aging characteristics and heat resistance to suffer. Hydrogenated rosin and resin esters are superior in this respect but naturally the price of the adhesive is increased. Zinc oxide is frequently incorporated and confers a very high tack as is instanced by surgical dressing tape.

Self-vulcanizing adhesives—Where high bond strengths, good aging properties and improved resistance to heat are required, self-vulcanizing solution is used. This is usually supplied in two parts: sulfur in one and an accelerator in the other.

Heat Speeds Cure

When the two parts are mixed, the stability of the solution is sufficient to allow one day's production. On drying, vulcanization begins. A complete cure can be effected rapidly by heat or will take place over one to three days, depending on ambient temperatures. These products are used mainly in bonding rubber to itself and for foam latex building.

Rubber cements—Natural or reclaimed rubber can be compounded together with tackifying resins and fillers to produce heavy-consistency, high-strength, gap-filling cements which will bond firmly to metal, wood and concrete. The formulations can be tailored for heavy duty such as is required in laying flooring and bonding ceramic tiles to cement. In addition, rubber cements are used in the automobile industry where one surface to be bonded is frequently metal. The aging properties and heat resistance of this type of adhesive are good, and rugged service conditions can be met adequately.

Latex adhesives—These materials are ideally suited for bonding porous surfaces such as textiles, paper and leather. An additional important use

Industrial Applications of Rubber-Based Adhesives

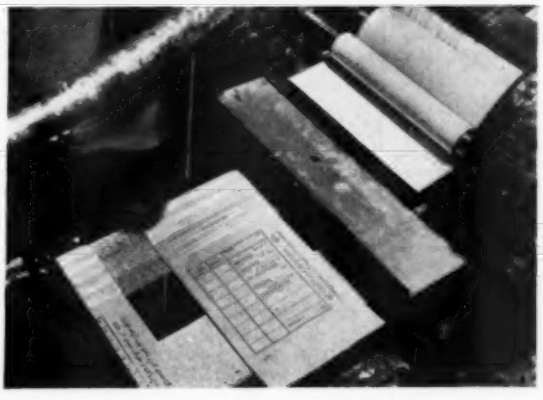
Rubber solution adhesive is used to lay rubber flooring. Solution adhesives are generally used with difficult, non-porous surfaces.

Bonding leather to felt with latex adhesive. When a latex formulation is applied to a porous surface, very rapid tack development ensues.

Rubber liferafts, now standard equipment for the British Royal Navy and Merchant Marine, are built up with the aid of a self-vulcanizing solution adhesive providing high bond strength and good aging properties.

A self-vulcanizing rubber solution bonds the rubberized fabric cover to these self-sealing gasoline tanks used by the RAF.

Latex being applied to self-sealing envelopes. When dried, the coated surfaces can be bonded together with hand pressure.



Floor screed being laid down in a hospital contains latex to help improve the adhesion of the compound to the substrate.

is as an additive to cement screeds, where its presence increases the adhesion of the screed to the substrate.

Latex can be compounded in the same way as solution adhesives, *i.e.*, with resin emulsions, to tackify the rubber. The rubber film deposited from latex is stronger and has better aging characteristics than solution-deposited films because it has not been subjected to degradation by milling.

When a latex adhesive is applied to a porous surface such as paper, very rapid tack development ensues. This is due in part to the water wicking into the surface, leaving the rubber particles to coalesce. The wet tack can be increased by additions of casein and water-soluble gums. These tend to reduce the water resistance of the dried film, however; where this is not permissible, water dispersions of insoluble resins can be used very satisfactorily.

Vulcanizing Film

As with solution adhesives, if the deposited film can be vulcanized, aging charactertistics can be improved. Self-vulcanizing latex adhesives can be supplied, usually in two parts, to fulfill this function. They are formulated in a fashion similar to that of the vulcanizing solution adhesive.

One outstanding property of latex adhesives is the property of dry tack bonding. Two coated surfaces, completely dried, will when pressed together form an instant bond. Use is made of the phenomenon in the manufacture of self-sealing envelopes and cartons.

The first stage in the production of solution adhesives is the milling of the raw rubber. This is a very critical process; the amount of milling controls the viscosity/solids relationship of the final product.

Where insoluble fillers or chemicals are included in the formulation, it is usual to incorporate them at the milling stage to ensure uniform dispersion throughout the rubber. A two-roll rubber mill or Banbury-type mill are usual for this process.

Following milling, the stock is frequently steeped in solvent to produce a soft swollen mass. This procedure keeps final mixing time to the minimum. When the jelly-like stage has been reached, the mass is transferred to a mixing hopper. The type used will depend on the final viscosity required. For heavy cements a Z-shaped blade or plain inter-meshing blade mixer of the Beken type is used. However, for light solutions, a simple agitator is sufficient.

Any further ingredients such as filler slurries or resin solutions are added to the steeped rubber in the mixer and, finally, solids content and viscosity are adjusted by addition of further solvent. It is highly desirable to have water-jacketed mixers to prevent excessive loss of volatile solvents as this is both wasteful and dangerous.

The final production test in the formulation of solution adhesives is to subject a specimen to physical testing. This ensures that the performance of the lot is up to specification.

Latex adhesives are generally of lower viscosity than solution adhesives and are not compounded with heavy fillers. The mixers required, therefore, are of the lighter variety such as simple drum-type stirrers. The complete manufacturing operation can be carried out in one container.

Additions of emulsified resin solution must be carefully controlled: particle size must not be too coarse. Solutions of water-solubles such as glues and thickening agents are added to adjust wet tack and viscosity characteristics respectively. These materials also control the degree of penetration into the substrate. For vulcanizing adhesives, the sulfur and accelerator are first ball milled and then added as dispersions in the usual manner.

Additional ingredients such as bactericides, anti-foamers and wetting agents are used where required. During the entire process, care must be taken to keep the pH at the correct level.

Finally, as with solution adhesives, solids content and viscosity are adjusted and the finished adhesive is subjected to other physical tests as required by the performance specification.

During the post-war period, the requirements which adhesives have been called upon to meet have become increasingly demanding, particularly with regard to rapid tack development, reduced setting times and increased resistance to heat and aging. In addition, there has been a wider variety of surfaces to be bonded.

To keep pace with industrial requirements, the formulator has been investigating the properties of diverse additives, with particular emphasis on surfactants and polymers. The latter can be used to boost an adhesive's specific features and there are numerous examples of this in industry.

Quicker and Cleaner

Ceramic tile adhesives based on rubber are relatively new, but they have already been accepted as the cleanest and quickest method of securing tiles to a variety of surfaces. Here the problem was to provide an immediate bond which would be sufficient to prevent slip on a vertical surface.

Transparent self-adhesive tapes have come into common use and owe their popularity to the adhesives chemist who provided the correct rubber resin compound to "stick to anything."

Heated sub-floors have presented a problem, but a flooring adhesive with good aging properties at continually elevated temperatures has been produced and provides permanent bonds. Much in the same way, automobile manufacturers' requirements have been raised. The export market demands that cars withstand both arctic and tropical conditions.

About the Author . . .

H. J. NORTHEAST joined Dunlop Rubber Co. 23 years ago and, until the war, worked in the chemical laboratories. After serving as a captain in the Royal Signals, he rejoined Dunlop in 1946. When the Compositions Division was formed he became its assistant sales manager. In 1957 he was promoted to the position of sales manager of that division of Dunlop.

This is an outstanding example of rubber adequately fulfilling a function where flexibility is a prime requisite.

Conductive rubber adhesives have been called upon for many applications. An important example is for bonding flooring in operating theaters where a build-up of static electricity could be fatal.

High-Speed Carton Sealing

Latex adhesives have also been developed to keep pace with the increasing tempo of industry. In the paper and board conversion industry the development of self-erecting cartons, the flaps of which are precoated with latex, has cut transportation costs considerably. The cartons are shipped flat and are set up by the user who needs only light hand pressure to seal the flaps. Self-seal envelopes make use of this dry tack property in the same way.

The speed of conventional carton-making machinery has steadily increased. Nevertheless, quick-sealing latex adhesives have still kept abreast, providing instant bonds between highly finished kraft board surfaces.

In textile bonding, latex has provided the answer for yarn splicing where the bond is under tension fractions of a second after being made. Tufted carpets rely on latex for complete anchorage of the pile to the hessian backing. A similar requirement is involved in the manufacture of pile fabrics utilizing synthetic fibers. Here again, vulcanizing latex provides excellent adhesion between the fibers and the backing cloth.

Not only are natural rubber adhesives continuing to prove themselves in accepted applications, but they are able to cope with the latest requirements thrust upon them by new industrial developments.

The tremendous "do-it-yourself" market of recent years has been helped considerably by adhesives in general, but this is particularly true of rubber-based adhesives in formulations ranging from carpet-seaming latex to tiling mastics.

Epoxies Help Slenderize TV Waistline

Contoured implosion panels epoxy-laminated to the face of TV picture tubes are reportedly making possible significant design changes in television set models to be offered to the public in 1960.

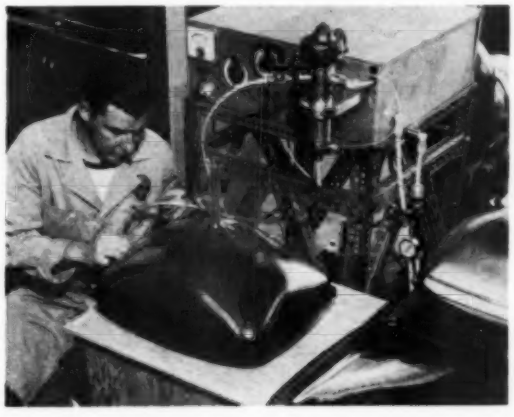
Conventional tubes generally require a separate implosion glass installed in the cabinet and about an inch away from the actual tube face. However, because the new tubes do not have to be recessed to allow for this separate plate, several inches of depth may be eliminated from the over-all set design. In addition, picture quality will be improved because dust can no longer collect in the dead space between the tube and panel, and glare will be reduced by eliminating a second glass surface.

Originally developed by Corning Glass Works, the tube requires about one pound of epoxy. Dow Chemical's DER 741-A, especially developed for this application, was the first resin to be used in commercial production. Recently, Shell Chemical Co. introduced its Epon 892 which is designed for tube laminating and other safety glass applications as well.

In production line laminating using the Dow epoxy, all glass parts are detergent washed, rinsed and dried to make sure they are dust-free. Special devices such as plastic spacers and shims are then used to secure the safety panel 60 mils from the tube face. Using infrared lamps, radiant headers or air ovens, both tube and plate are next heated to 210°-230°F. to speed the resin cure period.

The resin-hardener mixture is maintained at 200°F. and flowed into the 60-mil space by means of a flat-tipped nozzle. A lighted mirror directly underneath the filling station permits a check on the resin flow. After five minutes, sufficient hardening of the resin is obtained to make separation of the parts difficult, and after 20 to 25 minutes, the laminated assemblies are ready for packaging.

Laminating procedures depending on Shell's Epon 892 are similar to the above except that the latter cures at room temperature in eight to ten minutes.



An unevacuated bulb and implosion panel are laminated with Epon 892 in experimental work at Shell Chemical laboratory. After the resin cures, the bulbs are put through environmental tests.

By L. O. YOUNG
Applications Research Manager
Washington Research Center
W. R. Grace & Co.

Increasing Adhesive Strength with Fine Size Silicas

A study of six different adhesives shows that in many cases the addition of silicas makes for stronger bonds

Preliminary laboratory tests undertaken by W. R. Grace & Co.'s Davison Chemical Division have indicated that the use of fine size silicas in adhesive can significantly increase bond strength—in some cases by as much as 50 per cent.

In a study undertaken to work up concrete data on the use of silicas in representative formulations, tests were made on four structural adhesives and two adhesives specifically designed for coating applications. Different concentrations of Syloids 244, 975 and 978 were used. In addition adhesion tests were made with Davison's silica sol, both alone and combined with polystyrene latex.

Epoxy, polyester, polysulfide rubber, acrylonitrile, polyvinyl alcohol-acetate and neoprene adhesives were studied. Upon the addition of varying quantities of the silicas being tested, all of these adhesives except an acrylonitrile-type metal primer exhibited improved adhesion on stainless steel panels. In the case of the metal primer, our data indicated that a study of concentration, dispersion and pH of the filler might establish the reason for the *decrease* in adhesion.

In general, however, all three of the silicas tested increased adhesion, although not always in the same order or at the same concentration. Tested alone, with polystyrene latex and polyvinyl alcohol, silica sol did not produce any increase in adhesion.

The testing methods used were as follows:

Syloids 244, 975 and 978 were dispersed in the adhesive by hard stirring, except in the case of the polysulfide rubber which is formulated on a three-roll paint mill. In most cases, the testing was done on inch-wide stainless steel lap joints offering a one inch square adhesive area. The panels were degreased, coated with adhesive, clamped together, and heated until the adhesive was cured. In studies made with acrylonitrile adhesive, a resin tape was bonded to a test panel under pressure and temperature.

The neoprene cement was not applicable to the lap joint method and was tested by curing a spread panel and measuring the time required to peel a half-inch strip under a 500-gram load. When the peeling was proceeding uniformly, the time required to peel one inch of coating was measured.

Testing Epoxies

In tests made on the epoxy, the adhesives were catalyzed with eight parts of diethylene triamine per 100 parts of resin and cured at 82°C. for one hour. All three Syloids gave best results at the two per cent level. As the table below shows, Syloid 244 provided the greatest increase in adhesion, approximately 50 per cent.

Strength in Lbs. per Sq. In.

Syloid	*0%*	*0.5%*	*2%*	*5%*	*10%*
244	905	—	1363	1026	786
975	905	686	1059	845	—
978	905	774	1056	775	—

Syloid 975 gave an approximately 23 per cent increase in adhesion at the five per cent level in tests on a polyester formulation. A glance at the table given here shows that Syloid 244 at the two per cent level was almost as effective, producing an approximately 21 per cent improvement. The adhesive was catalyzed with three parts of benzoyl peroxide paste per 100 parts of resin and cured at 107°C. for one hour.

Strength in Lbs. per Sq. In.

Syloid	*0%*	*0.5%*	*2%*	*5%*	*10%*
244	1184	—	1436	1425	859
975	1184	1220	1274	1480	—
978	1184	847	719	1317	—

Syloid 244 and 978 at 10 pph and 975 at 25 pph gave better adhesion properties to polysulfide rubber than 30 pph of carbon black. Ten pph of Syloid 244 performed best, with an improvement of about 30 per cent over carbon black, as we can see by the following table.

Strength in Lbs. per Sq. In.

	Carbon Black	*Syloids*		
Syloid	*30 pph*	*10 pph*	*15 pph*	*25 pph*
244	146	192	174	—
975	146	133	126	166
978	146	173	166	156

A primer was used on the metal surfaces and allowed to dry 20 minutes before the adhesive was applied. The joint tests were cured at 82°C. for one hour.

All three of the Syloids used caused considerable *reduction* in the tensile shear strength of acrylonitrile; the adhesion decreased as the amount of Syloid was increased, as we can see from the table which follows.

Strength in Lbs. per Sq. In.

Syloid	*0%**	*0.5%**	*2%**	*5%**
244	4000	3041	1023	441
975	4000	3170	2396	797
978	4000	2264	1060	504

Note: *Concentrations are based on primer solution solids which contained 10 per cent solids.

The acrylonitrile type primer was applied to the panels, air dried one hour and heated for 15 minutes at 82°C. Resin tape was then applied and the joints were cured for one hour at 177°C. under 100 psi.

The adhesion characteristics of the neoprene-type base were improved by all of the Syloids at the five per cent silica level. The pattern of response can be studied in the table below. The base was in solvent solution with approximately 20 per cent solids. The silica concentrations given were based on total solution.

	Strength in Lbs. per Sq. In.			
Syloid	*0%*	*0.5%*	*2%*	*5%*
244	85	205	95	1180
975	85	908	115	2000
978	85	203	*	*

Note: *No appreciable movement after 300 seconds.

On the other hand, the adhesive properties of thermoplastic vinyl were not significantly improved by any of the three Syloids. With the low values obtained, a peel test such as was used for the neoprene material would probably have been a more appropriate means of evaluating adhesive strength. The joints were prepared by applying a 25.1 per cent solution of the resin to the panels, allowing them to air dry for 15 minutes, assembling the joints and curing the bond at 82°C. for one hour.

	Strength in Lbs. per Sq. In.				
Syloid	*0%*	*0.5%*	*2%*	*5%*	*10%*
244	344	—	567	147	—
975	344	—	70	112	157
978	344	—	356	274	126

On the basis of data developed in this study, the following general conclusions seem justified:

(1) Fine size silicas can be used to increase the adhesive characteristics of some of the epoxy, polyester and synthetic rubber adhesives.

(2) An aero-type gel such as Syloid 244 is the most versatile in this application.

It should be pointed out that the conclusions presented here are limited to Syloid-treated adhesives and unaged joints prepared from such adhesives. The effect of fine size silica on the ultimate life of the adhesive has not been determined.

The scope of this study was exploratory and was limited by design. To obtain a complete evaluation of fine size silica as an adhesive additive, factors such as concentration, degree and method of dispersion, pH, surface energy characteristics, and life tests would all have to be studied. Other fine size silicas and adhesives would have to be investigated to develop the picture in still greater detail.

Plastograph unit is used to mix fine size silicas into the adhesive formula. The apparatus shown is a miniature of the full-sized production unit.

First step in the testing procedure was to lay down a uniform film of adhesive on a test panel by the method shown here.

Test strips were joined under controlled pressure and heat. The epoxy, for example, was cured at 82°C. for one hour.

In tensile test of adhesives, an Instron tester was used to apply the load. The jaws operate at a constant speed rate.

The neoprene cement was tested by measuring the peel time of a half-inch strip under a load weighing 500 grams.

Adhesive — Bonded

Jet Aircraft Wings

Additional fuel storage space is provided by using a dry adhesive medium to seal the wings of Convair's new "880"

Some of the biggest adhesive joints ever made are sealing and strengthening the wings of giant new "880" jet transport planes now in production at the Convair Division of General Dynamics Corp., San Diego, Calif. Their purpose is to allow the big metal parts to carry fuel in virtually every available cubic inch of internal wing space—rather than in just a few large areas which might retain bulky elastomeric fuel cells.

Convair's wing-sealing technique is the result of a research and development program that cost over $250,000 following its institution several years ago. It involves the use of nitrile phenolic film made by Minnesota Mining and Manufacturing Co.

The latter product is obtainable as a dry or B-stage material in tape form and consequently can readily be assembled in the seams of sheet metal joints which are riveted prior to the oven-curing operation. Aluminum wing components are carefully cleaned, dried, and primed before they are assembled with the dry adhesive medium in order to assure maximal bond strength. Special rivets and bolts are next used to obtain positive clamping pressures on the adhesive-filled seams.

Nitrile phenolic tape is applied to the faying surfaces of a wing assembly. Note the white gloves used by worker to protect against the introduction of foreign matter.

Many sub-assemblies thus produced are individually pre-cured in a relatively small oven before the overall wing-baking process takes place. This is to prevent joint contamination and to facilitate the inspection of parts which may be completely inaccessible in a final assembly.

However, subsequent curing of the entire wing necessitates a large oven capable of maintaining a temperature of 320° F. ±5° or −10° F. for an hour ±5 minutes. After this cure period, the components are allowed to cool to room temperature in draft-free storage areas.

Electrical Curing Ovens

Importance of the adhesive joints is such that Convair has obtained one of the world's largest electrical curing ovens for the purpose of baking complete wing assemblies. Made and installed by Southern Engineering and Construction Co., Long Beach, Calif., the new oven cost $178,000. It has a 10′ x 80′ x 20′ work area and an 8′ x 78′ x 1½′ conveyor cart which rides on 170′-long steel rails. The cart can carry two wing assemblies (or loads weighing up to 20,000 lbs.), and any given cure cycle can be completed in 120 minutes or less.

The insulated steel structure of the oven was designed not only to

The top photograph shows part of the electronic control panel used to regulate the temperature of the giant curing oven shown on the right. After a five-minute cure at 320°F., the wing is allowed to cool to room temperature in a special draft-free storage area. Some sub-assemblies are pre-cured in smaller ovens before final assembly of the wing structure.

minimize heat losses, but to eliminate the possibility of free thermal paths through the insulation from inner to outer casings during heating operations. Bi-parting doors at one end of the oven are electrically operated and may be either manually or automatically controlled with push button or electrical timing facilities.

Oven heating elements are arranged in three groups to form a balanced load on a 440-volt, 3-phase, 60-cycle power supply; and they are capable of stabilizing the unit's temperature at 400° F. within 90 minutes when the heating compartment is empty, the starting temperature is 70° F., and recirculating air systems for all heater groups are in use.

Mechanical exhaust fans can be operated at two speeds, and at top speed will evacuate air at the rate of 10 per cent of the oven's volume per minute for a period of five minutes. These fans are controlled by an electric timer which is energized and interlocked with the operation of the oven's doors and heaters.

Besides providing safe operating temperatures for heating elements, the oven's air circulating system permits the control of temperatures of 100° F. to 550° F. within tolerances ranging from ±5° F. to ±10° F. in all areas 6″ above the floor. Louvers for all internal air circulation ports can be adjusted to change air diffusion either vertically or horizontally in order to compensate for different removal rates.

Basic oven temperature control is maintained by Brown Electronic strip-chart recorder-controllers with an electro-pulse relay that has a rate of approach adjustment and automatic reset for each heater group. Eight strip-chart recorders and appropriate accessories are employed —four of them to record temperatures at 16 points within the work chamber, and four to record load temperatures.

Burnout Protection

A Partlow controller with thermocouple burnout protection and manual reset is provided for each heater group to prevent difficulties due to excessive temperature shut-off. Allen-Bradley combination contactors and fusible disconnect switches, together with suitable control relays, afford a good margin of safety for heating element circuits. In the event of any malfunction in the operation of blower or exhaust fans, the oven's heaters will be quickly de-energized by a "fail-safe" interlock system.

Adhesive-assembled test specimens are incorporated in each load of parts that undergo the curing operation, so that Convair's engineering test laboratory can take steps required to evaluate the quality of resultant adhesive bonds.

Exhaustive preliminary tests have shown that properly-bonded wing assemblies are:

(a) Much stronger than the same components would be if assembled with rivets alone.

(b) Highly resistant to low-temperature peeling action.

(c) Impervious to jet fuels with 30 per cent aromatics added for periods that should exceed ten years.

(d) Non-explosive and non-toxic for all practical purposes.

(e) Flexible enough to prevent leakage despite severe structural deflections and internal tank pressures of 15 psi.

(f) Highly resistant to ozone, fungi, bacteria, water, and acids common to fuel storage.

(g) Able to withstand service temperatures from —65° to 250° F.

In the event that adhesive-assembled wings must be repaired, Thiokol-type sealants can be used in a more or less conventional manner because they are quite compatible with buna-N phenolic film.

It is necessary to make optimal usage of potential fuel storage space in the wings of aircraft now being produced because increased speeds mean higher fuel consumption and limited airfoil thickness.

Adhesive Products and Techniques for

Combining Vinyl and Cloth

By ROBERT S. BROOKMAN
Resin Specialties Development
National Starch and Chemical Corp.

Formulations of adhesives for vinyl-cloth laminating have opened new merchandising approaches in the race for desirable, economical and attractive combinations. Flannel-backed vinyl tablecloths, knitted cotton-backed vinyl upholstery materials, and cotton drill or duck wall coverings are only a few of the many products that have to some extent been adhesive-inspired.

By combining vinyl film or sheeting to various supporting materials, a new product is made that can often be employed where neither the vinyl nor the supporting film was able to be used before. The vinyl contributes decorative value due to its pigmentation, printing and embossing. It is essentially waterproof and provides a thermoplastic surface which is advantageous in the further processing of the laminate.

The material combined with the vinyl usually increases the strength of the film, though in many cases the vinyl may be the stronger member of the combination. Often the vinyl is combined with a fabric to give the end-product a more traditional eye appeal.

Successful combinations of vinyl films with diverse fabrics are dependent upon two factors: the use of the proper adhesive and the choice of the right laminating method. In the following article, these two items will be covered in some detail with respect to vinyl combinations with both natural and synthetic fabrics.

In the past few years there has been extensive adhesive development in this growing field, and there are now four basic types of adhesives available for vinyl-to-cloth laminating:

(1) Vinyl chloride copolymer solutions.

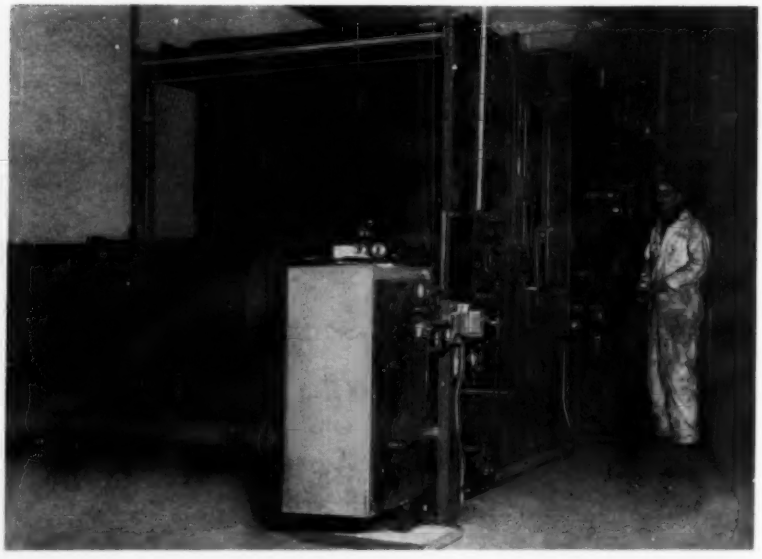
(2) Synthetic rubber latices.

(3) Vinyl chloride copolymer latices and emulsions.

(4) Plastisols and organosols.

Recently, the most active developments have been in the latter two types, as will be seen from the following discussion.

Vinyl chloride copolymer solutions—It is desirable to prepare a solvent type adhesive at high solids and relatively low viscosity. At the same time, the solvents used must have little effect on the vinyl film. Although to aid in bonding a slight bite into the vinyl by the solvent is desirable, the adhesive may not be allowed much dwell time while wet on the film. This is because of the distortion caused by swelling. The use of solution adhesive, therefore, imposes rather rigid machining characteristics on the laminator.



The combination laminator-embrosser shown above will laminate, emboss and valley print any plastic film in one operation. It can be used in both wet combining and thermoplastic mounting operations. *Photo courtesy of Lembo Machine Works, Inc.*

Solvent-Based Adhesives

Solvent-based adhesives are usually formulated with between 15-30 per cent solids. They generally consist of a solution grade PVC/PVAC copolymer, or preferably, a PVC/PVAC resin containing polar groups—to aid in adhesion to cellulosics—plasticizers, and occasionally modifying materials such as synthetic rubbers. The common solvents used are methyl-ethyl-ketone, methyl-isobutyl-keytone, toluene and acetone, as well as blends of these. If a very flexible lamination with moderate bonding and low heat seal temperature is desired, high plasticizer levels are maintained. For higher bonds and firmer lamina-

tions, low plasticizers levels are used.

The solvent-based adhesive could do well in this field because of the available raw materials that can easily be dissolved. The result is formulation versatility.

On the negative side, however, is the fact that many solvents attack vinyl film, imposing difficult machine conditions. In addition, solvent is expensive and generally goes "up the chimney." These objections must be coupled with the fact that solvents create a potential fire hazard.

To the best of the author's knowledge, few laminators are using solution adhesives for combining vinyl to cloth. The most important application of the adhesives would be in a thermoplastic mounting operation where the fabric is the web to be coated.

Synthetic rubber latices—Adhesives for vinyl-cloth laminating which contain just plain synthetic rubber latex machine poorly. The latter foams and tends to skin rapidly. It is not as thermoplastic as PVC, nor does it have the same order of adhesion to vinyl film.

These factors limit its use as a vinyl adhesive. Synthetic rubber latex however, will often impart great flexibility to the finished laminate. Today, rubber finds its greatest use in blends with PVC copolymer emulsions to improve their flexibility.

Only a few types of synthetic rubber find application as vinyl adhesives. Neoprene is limited because it tends to extract plasticizer from many vinyl sheets. Styrene and butyl rubbers have poor adhesion to vinyl. Acrylonitrile latex is the most acceptable for this use and is formulated with synthetic or natural thickeners and defoamers for use as a vinyl-cloth adhesive.

Vinyl chloride copolymer emulsion and latices—This type of product has seen very extensive use in the past few years because it does provide the highest possible bonds using the wet combining method which will be outlined later in this article. These products machine very well and possess superior bonding qualities because the PVC present in the copolymer has excellent specific adhesion to vinyl film while the copolymer, usually PVA or a polar material, has good adhesion to the cellulosic fabric.

The adhesion is greatly aided by the presence of water which swells the fabric fibers and carries the polymer to the surface of the fabric where it provides excellent mechanical anchorage. The PVC1/copolymer adhesives are limited by the fact that they detract from the flexibility of the laminate ("hand") due to the fact that the copolymer cannot be highly plasticized and still remain adhesive. In addition, fabric penetration due to the presence of water stiffens the cloth.

Adhesives for Combining Vinyl and Cloth

	PVC Copolymer Emulsion	*Modified Plastisol*	*PVC Solution*	*Synthetic Rubber Latex*
Bond	Highest	Low	High	Fair
Hand	Firm	Very Flexible	Varies	Varies
Mileage	Excellent	Poor	Good	Good
Water-Resistance	Fair	Excellent	Excellent	Fair
Machining	Excellent	Excellent	Poor	Poor

Satisfactory Emulsions

A satisfactory copolymer emulsion (one that is relatively high in the polar copolymer) cannot be highly plasticized without becoming a gummy, non-adhering mass. These materials are also water-sensitive because of the surfactant required for emulsification. They are not recommended where 100 per cent water-resistant laminations are required.

Adhesives in this category are generally prepared from copolymer emulsions and commercially available latices. They are plasticized via an emulsion of almost any common PVC plasticizer and thickened by a synthetic thickener to adjust to coating viscosity. In some cases, synthetic rubber latices, acrylic emulsions, and many other compatible materials are added to obtain specific properties.

To summarize, it might be said that the PVC copolymer emulsion has seen such widespread usage because of its high bond strength, good machinability, and excellent economy.

Plastisols and organosols—A plastisol is a dispersion of relatively high molecular weight PVC resin in plasticizer. The resin particle is swelled by the plasticizer at room temperature and complete solution takes place only at elevated temperatures when the plastisol is said to be cured. There is, however, some solvation that takes place at room temperature, as is shown by increased viscosity of the plastisol.

This thickening is dependent upon the relative solvating efficiency of plasticizers used. An organosol is a plastisol compounded with various volatile diluents or partial solvents to aid the fluidity and lower the cost of the plastisols.

Bonds produced by plastisols or organosols tend to be comparatively moderate in strength and are therefore somewhat limited in value as vinyl-cloth adhesives. Lack of bond strength is due to the softness of the plastisol and its inability to swell the fibers of the fabric, as well as the high processing temperatures required for satisfactory curing.

They are used by some laminators because their high plasticizer content makes possible very flexible laminations with excellent hand and drape. In addition, these dispersions are resistant to water and can be used in laminations where this characteristic is important. Plastisol adhesives will not dry at room temperature and therefore can be left overnight in a glue pot or on a gravure or engraved roller without cleaning up.

Still another factor limiting the use of plastisols is mileage. Plastisols have a tendency toward viscosity increase, particularly during warmer weather. They will not give mileage equivalent to other types of adhesives. This point requires some special explanation.

Let us set up the hypothetical case of a lamination being prepared by the wet combining method using a gravure and doctor blade to do the coating. We apply the adhesive with a 50-line per inch gravure roll engraved in a triangular hylicoid pattern. In this application, one gallon of the copolymer emulsion coats 130 yards of film while one gallon of the plastiol coats only 100 yards of vinyl. At the same time, 10.5 lbs. of the plastisol coats only 100 yards only 9.0 lbs. of (wet) emulsion during the same operation.

This phenomena may be explained by understanding the rheological properties of the materials. The plastisol is a dense dilatent material while the emulsion is thixotropic. Therefore, when subjected to the shear of the spinning gravure the emulsion becomes more fluid and transfers or prints a perfect gravure pattern on the film. The plastisol increases in viscosity as the shear is increased and because of this does not allow the gravure to print a perfect pattern on the film.

Instead, it smears the moving web and ultimately applies more adhesive by volume of a denser material.

This means that even more is applied by weight. At the same time, the bond attained by a good PVC copolymer emulsion is often 50 per cent better than the best plastisol. This is probably the reason why the plastisol adhesives do not give good mileage.

Plastisol and organosol formulations for adhesives require a very specialized technique because the materials which usually cure at 350°F. must be made to fuse between 260°-300°F. for use as vinyl-cloth adhesives. At the same time they must maintain reasonably stable viscosity, must be of low cost, and, of course, must be adhesive.

Many of these properties are direct contradictions of each other, *i.e.*, low temperature cures dictate the use of high solvating plasticizers which generally cause rapid viscosity increases at normal temperatures. Much of this has been remedied by thinning these materials with high boiling diluents to make them organosols. The low cost requirement is met by using large amounts of common fillers at some sacrifice to softness and adhesion.

"Stir-In" Grade Resins

Most plastisol or "stir in" grade resins are 100 per cent PVC and not polar enough to provide specific adhesion to fabrics. Therefore, various adhesion promoters are often added to increase the adhesiveness of the plastisol or organosol.

Three-ply laminations are plastisol adhesive applications which take advantage of the fact that it is a 100 per cent solids material and has no volatiles. In this case, a sandwich of a fabric between two vinyl sheets is ultimately desired. If the fabric is an open weave type, the plastisol is coated on one web of vinyl and normally wet combined to the fabric. Then the lamination is super-heated to the point where the adhesive softens and flows through interstices of the fabric so that the second web is now heat-sealed to the soft adhesive.

About the Author . . .

ROBERT S. BROOKMAN's work at National Starch and Chemical Corp. is concerned primarily with the development of adhesives for vinyl combining. He had previously worked as a plant chemist with a major producer of vinyl films. Mr. Brookman is working toward an M.S. in Polymer chemistry at the Polytechnic Institute of Brooklyn.

When a denser tight weave fabric is employed, both webs of vinyl are coated and combined to the fabric and the adhesive cured within the sandwich construction. This is only possible with 100 per cent solids materials, otherwise the volatiles would blister the films as they try to escape.

It must be noted at this point that were the plastisol or organosol to be fully cured during lamination (i.e., develops its ultimate physical properties), strong bonds might result. However, it is not possible to bring the vinyl up to the fusing temperature of the plastisol. We believe, therefore, that the plastisol adhesives being used today have relatively low bonding strength because they are never fully cured.

Plastisol and organosol adhesives have a firm place in vinyl-cloth laminating where water-resistance, extreme flexibility, and the need for 100 per cent solids material are required, even at the expense of bond and adhesive economy.

Without going into too much detail here, a word might be said about nylon-vinyl laminating. Nylon fabric is laminated to vinyl primarily to take advantage of the strength of the nylon as a support for the vinyl. The synthetic fabric is relatively non-porous and is unreceptive to laminating adhesives.

In most cases, the fabric must be primed or sized with a material that will bond to the normal laminating adhesives. These primers are generally of the type that chemically change the surface of the nylon and make it more receptive to adhesives. They are usually reactive thermosetting types.

Although the list of materials that are desirable in combination with vinyl film and sheeting is long and diverse, the adhesives employed have much in common and the machinery used in processing is generally the same or similar. At present, there are basically three general types of processing methods, each offering distinct advantages to the many different kinds of converters.

Off the calender combining— This technique follows normal vinyl processing procedure for calendering until the molten vinyl leaves the last calender roll. At this point, it is combined via heated nip to the fabric coming from an overhead unwind. The lamination then passes over a series of cooling drums and is rewound. In some cases, the vinyl bonds satisfactorily to the fabric by simple mechanical anchorage. Most often, the fabric must be adhesive-coated to aid in bonding the film.

The adhesive used should be thermoplastic so that it can be coated and cured on the cloth prior to the calendering operation and heat-reactivated by the hot vinyl film off the calender. This is usually brought about by a bank of infrared heaters.

Calender Combining

In many respects, calender combining is probably the best available method because greater production, satisfactory bonds and adhesive economy can all be realized with only a slight sacrifice of the physical properties of the lamination. Though the adhesive coating or the molten vinyl surrounds the fibers of the fabric and impairs the tearing and tensile strength of the finished product, at the same time it improves the bond between the two surfaces.

Because of the large capital in-

vestment, and because the cloth must often be adhesive-coated prior to combining, calender combining is used today only by the larger laminators.

Thermoplastic mounting—This is the most practical way to laminate two impervious surfaces such as vinyl and metal, or vinyl and Mylar. It is sometimes also used for combining vinyl-cloth where the lamination requirements are not too rigid.

Essentially this process consists of coating one surface with the adhesive, usually the cloth, removing the vehicle in a drying tunnel, and combining the second surface while the adhesive is in a warm tacky state. Some vinyl, converters coat, dry, and rewind the cloth, and then seal it to vinyl film by heat reactivation.

Thermoplastic mounting offers as its major advantage the possibility of attaining high production speeds. With this method, it is possible for one manufacturer to do the coating and another to handle the combining process.

However, the method is very rarely used in vinyl-cloth laminating because high bond strengths are difficult to obtain, relatively large amounts of adhesive are used, and a rather inflexible laminate results. Because it requires coating the fabric, much of the adhesive needed for bonding is absorbed below the glue line.

Wet combining—This technique is the most popular vinyl-cloth combining method because of the versatility of lamination possible with a relatively small capital investment. In this method, the vinyl film or sheeting is coated with an adhesive by means of a gravure roller metered by a doctor blade.

Before any heat is applied to the adhesive, the fabric is married to the coated vinyl and immediately passed over one large heated drum or a series of smaller heated drums. The adhesive is cured with both webs held in intimate contact by tension, thus effecting a bond.

After the actual bonding has taken place, the lamination is superheated and presented to the chilled embossing roller which engrains it with its pattern. The finished combination is then cooled over a series of drums and rewound.

The major advantage of this method is that the adhesive is cured and the bond developed at the same time. This allows the wet adhesive to penetrate partially into and swell the fabric, providing excellent mechanical anchorage without appreciably stiffening the lamination. Wet combining actually lowers adhesive costs because all the adhesive applied is utilized for bonding. No adhesive is lost by fabric penetration, other than that required for mechanical anchorage.

Another reason for the popularity of this technique is the versatility it affords with existing equipment. It is possible to prepare 3, 4, and 5-ply laminations by wet combining. In addition, using this technique other materials such as urethane foam and paper can be combined to vinyl.

It should be pointed out that since wet combining is the most extensively used method, machine development for the technique has proceeded the furthest and many adhesives have been especially developed for it.

Laminating Methods for Combining Vinyl and Cloth

	Calender Combining	*Thermoplastic Mounting*	*Wet Laminating*
Production Speed	High	High	Low
Bond	High	Medium	High
Hand	Firm	Firm	Softest
Adhesive Economy	Good*	Poor	Excellent
Versatility	Limited to 2 plies	Unlimited	Unlimited
Capital Investment	Very High	Varies	Low

Note: *In some cases, no adhesive is used.

Laying Down the Line

The New York City Department of Traffic recently contracted for 140,000 feet of vinyl plastic ribbon to be glued down as crosswalk-markings in the city's midtown area.

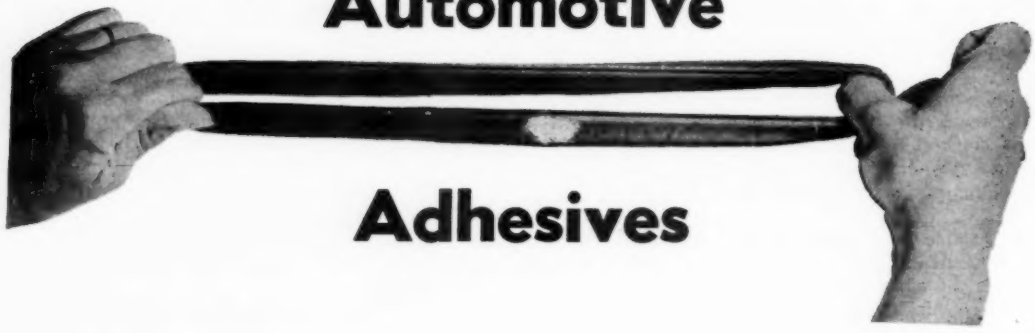
The marking is bonded to the street with a rubber-resin adhesive and then smoothed down with a small roller. The life expectancy of the plastic ribbon is expected to be about three years as opposed to that of the usual paint markings that wear off the busy intersections in about 50 days.

According to Traffic Commissioner T. T. Wiley the plastic costs about 40 cents a foot, installed. The present technique is to brush-coat both the plastic and the asphalt and wait until both are dry before laying down the marker. Arrangements are now underway for facilitating the installation by spraying on the adhesive.

The technique was developed by Glo-Line, Inc., of New York.

A vinyl plastic crosswalk marking is glued in place in New York's Times Square. The glued marker is expected to last three years.

Automotive Adhesives



Torture testing of weatherstripping used on Ford and General Motors automobiles proves the adhesive-bonded butt joint to be even stronger than the rubber itself

Experts agree that bonding at butt joints is the real test of strength for an adhesive. As a matter of fact, design and product engineers continually are advised by adhesives manufacturers to avoid a situation where adhesion must be accomplished at a butt joint. However, there are situations where design factors make a butt joint mandatory. Such is the case at the Davidson Rubber Co. plant in Charlestown, Mass., where much of the weatherstripping used on the doors of the nation's automobiles and trucks is produced.

A Bostik adhesive, made by the B. B. Chemical Co., Cambridge, Mass., is making it possible to bond these butt joints so that torture tests conducted by Davidson have proven the bonds to be stronger than the rubber itself.

Currently in production is weatherstripping for Ford truck doors. The first step is the formulation of the rubber strips in varying lengths. Davidson's presses are able to make strips up to eighteen feet in length. The truck door contours and dimensions are such that six sections of rubber strip of varying lengths must be bonded, one to the other. This necessitates, of course, five separate bondings, and all of them are at butt joints.

Obviously, the setting-up time of the adhesive is a critical factor in this production. The butt surfaces are dipped in the adhesive, clamping devices are used to hold the joints together, and then the complete unit of weatherstripping is conveyed through heated curing ovens where the temperature is in the vicinity of 200° F. The only reason for the use of the clamping device is the extremely awkward, snake-like shape of the weatherstripping and its three sharp-angled corners.

Bonded Heater Gaskets

Another application of the same adhesive is that for Davidson's high-speed assembly of clicker or die-cut gaskets. Currently, such gaskets are being made for use on heaters in General Motors automobiles. Here again, a butt joint is accomplished with the adhesive at four separate spots, but only manual pressure by the operator is necessary to set up initial adhesion before the gaskets enter the curing oven on a belt. No clamping device is needed. Again, the adhesive is applied by means of a simple dipping process. The same result occurs: the adhesion accomplished is unaffected by any subsequent rough handling or fitting during auto assembly. Tests indicate that a break will occur at a spot other than that where the adhesive was applied.

Another large-scale production for the automotive industry at Davidson is that of round rubber seals for air ducts on air conditioners for such cars as Lincoln, Mercury and Edsel.

An interesting operation here is the one that makes round rings out of straight pieces. Molded shapes are produced of sponge rubber in multiple molds, but for compactness, high production, mold simplicity and economy, all pieces are straight.

To form them into rings it is necessary to use only a simple device to shape them into a round configuration and, more important, to accomplish effective bonding. First, the butt ends are dipped in the adhesive. Then the strips are placed within jigs shaped like the finished seals. The rubber strips are under slight compression and, conforming themselves out against the jigs, become shaped while their ends are held firmly together at the same time. Finally, the jigs with the seals in them pass through heated chambers on conveyors, to complete the conforming job and cure the adhesive. Permanent bonds with the same excellent qualities as the weatherstripping and the gaskets are the result.

The development of adhesives for such special purposes in automotive products and for general purposes, as well, has been stimulated by many factors in recent years. One of these is the trend in many products toward rubber based and plastic resin components for housing sealing, vibration isolation, noise dampening, and many other functional and appearance purposes. In some cases, strength is a fac-

tor, as it is certainly at Davidson where the butt joint use necessitates a formulation that provides high ultimate strengths. In other cases, service conditions are the primary consideration. Perhaps most important are adhesives and methods like these that will help to fabricate a component or finished product at less expense by saving material or operations.

Examples of service conditions that adhesives must resist are: exposure of the joint to corrosive fumes or liquids; high humidity or moisture; high velocity blasts, as in aircraft; and joint flexure, as in many components. Because of the infinite number of formulations that are available in many basic types, such as the rubber, resin, and epoxy groups, the designer does not have the clear-cut choice in specification that is available to him when he is using a rigid fastener.

The following recommendations will help insure the selection of the best adhesive for a particular application:

(1) First consider product function. Investigate not only strength requirements, but any ususual requirements that are to be encountered in service.

(2) Compare the characteristics of standard adhesives as they apply to the materials to be bonded. Try them first if they look appropriate.

(3) Next investigate the possibility of a special formulation that will better fit the particular requirement.

(4) Check with adhesive suppliers on other applications using the same formulations and the success that has been enjoyed with them or, conversely, the reasons for their failure.

(5) Consider problems of application, whether by brush, spray, roller coating, troweling, dipping or other means. Often, the production advantages represent the only really significant difference in performance between two very close formulations.

(6) Check the method of curing —air, oven, infra-red heat, or other methods—and the time required to effect the cure.

(7) Determine the form in which the adhesive is available and, of course, cost of one type versus another.

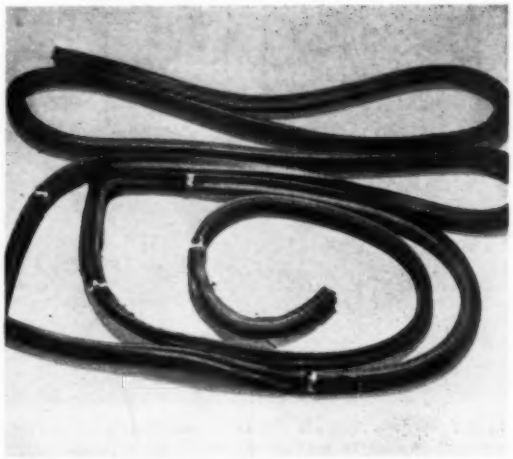
(8) Finally, subject the actual assembly to production laboratory tests in order to double check its applicability.

These are general requirements only. Close cooperation between the user and supplier is generally necessary to obtain best results.

FROM PRESS TO FINISHED RUBBER PRODUCT

Operator pulls 18-foot sheet of weatherstripping from press at Davidson Rubber plant in Charlestown, Mass.

More adhesive is poured for joining operation on assembly line. Sections then go to ovens for final bonding.



A torture-tested weatherstrip unit for a truck door. White paint marks five butt joints bonded by adhesive.

STAFF REPORT

Adhesives for Prostheses

Special adhesive formulations can be used on the human body to attach artificial limbs and facial features

Adhesives play an important role in the application of prosthetic parts. Every year, thousands of people are seriously disfigured and maimed through accidents and disease, while many others are born with congenital deformities. Many of these people can be helped through plastic surgery, but not all. For those who cannot be helped, there is inevitably a problem of adjustment and rehabilitation. One way of meeting this problem is through the use of prostheses, artificial, life-like body parts, many of which are kept in place with adhesive materials.

Much work has been done in this area in recent years, especially since World War II. A great deal has been done by the United States Army Prosthetics Research Laboratories at the Walter Reed Army Medical Center in Washington, D. C. Two New York City firms that specialize in the production of artificial limbs and facial parts are Tenenbaum Prosthetics and the firm of Lillian Bettinger.

Adhesives are used primarily to keep facial structures, such as the eyes, ears and nose in place. They are also used wherever the remaining stump is inadequate and where cavities must be filled in. In order to be used in this application, an adhesive must meet certain minimal requirements.

According to Dr. Fred Leonard, chief of the Plastics Development Branch of the United States Army Prosthetics Research Laboratory, "The hydrophobic nature of the prosthesis and hydrophillic nature of the skin, the presence of natural skin oils and sweat and the necessity for natural skin movement are some of the factors which combine to decrease the effectiveness of the adhesive bond."

In this case, the right ear was constructed from a mirror image of the left. Use of adhesives makes it possible to bond the prosthetic ear in place.

Requirements for Adhesives

The first requirement is that the adhesive must be completely free of toxic or irritating ingredients. Quite often, allergy tests are conducted in advance in order to avoid difficulties after the prosthetic device is in use.

Not only must the use of poisonous and irritating material be avoided, but prosthetic makers also eliminate any material which causes discomfort to the user. This includes any material which has an offensive odor, is difficult to apply, and even material that feels uncomfortable on the skin. It is stressed that persons who require prosthetic parts may already be under extreme emotional stress. Above all, an attempt is made to give patients as few additional problems as possible.

The second point extends into esthetics. The adhesive materials must be completely undetectable. They should be either transparent or flesh colored and must dry with a dull finish. Use of flexible material permits movement and does not crinkle the

Adhesives are used where the remaining anatomical structure is not adequate to hold the prosthesis firmly in place, as in the photographs above.

skin underneath when the adhesive is dry.

The strength of the adhesive is of extreme importance. If a part should become loose and fall off, the result would be shocking to onlookers and painfully embarrassing to the patient. It must be remembered that the appliance is subject to a certain amount of gravitational pull and that changing facial expressions exert constant force on the adhesive and the part.

A problem often encountered here, however, is that an adhesive which is strong enough may require a solvent for removal, which irritates the skin, whereas an easily removed adhesive might not have the required strength. Water soluble adhesives fall short of the necessary requirements as they would cause difficulties every time the patient washed or perspired.

It may seem at this point that rather contradictory demands are made of adhesives in this application. While the adhesive in use must be strong, it must also be removable in order to permit the skin to breathe and to permit the skin area under the appliance to be cleaned. On the other hand, it is also desirable that the adhesive be effective for several days at a time as there might be occasions when it would be embarrassing to remove the prosthesis.

Finally, not only must the adhesive utilized be compatible with the skin, but it must also be compatible with the prosthetic device. Prostheses are constructed from various elastomeric materials. Adhesives used with these appliances must, obviously, be able to bond the elastomeric material to the skin. However, the adhesives must also be composed of ingredients that will not be harmful to the prosthetic appliance. Some adhesives cause hardening or discoloration, while others might actually cause disintegration of the prosthesis.

Another difficulty sometimes encountered is that some adhesives tend to build up at the bonding area of the prosthesis. Although this does not destroy the materials of which the appliance is composed, it nevertheless, destroys the utility and appearance of the device. Bonding becomes more difficult and the prosthesis is distorted and warped.

As may be seen, the minimal requirements that an adhesive must meet in this application are rather stringent. It should also be pointed out that even an adhesive having all the properties mentioned, will not serve if the prosthesis is not perfectly molded to conform with the existing facial structure.

The construction of a prosthesis requires a high degree of technical skill and some art. Each part is individually constructed and fitted. Organizations specializing in the creation of prosthetic parts attempt to help each individual to look as normal as possible and, eventually, by minimizing the differences, to bridge the gap between the disfigured person and the society in which he lives.

Prostheses may be made to duplicate all of the extremities and facial features. Where extremities are created, an impression of the normal member is made. From this, the model is transposed sculpturally and is created in plaster. A metal mold is cast from this model and from this final mold, the prosthesis is completed. The finished appliance is light, durable, flexible and washable.

Where movement is required, as in the fingers, flexible metal frames which follow the anatomical structure are embedded and cured within the material. The fingers can then be bent into various positions and adjusted to hold light objects. For heavy work, a hook is interchangeable with the hand. Where facial disfigurement exists, an impression of the patient's facial structure is used as a model. Eyes and ears are constructed from mirror images. In the case of the nose or chin, the facial part is sculpted to conform with the existing structure.

The nose, made to conform with the facial structure, is secured with an adhesive.

Bonding the prosthetic part securely over the disfigured ear, the adhesive utilized here is completely undetachable and lasts for at least 24 hours.

Because appearance is as vital as function in the use of an appliance, prosthesis makers take into consideration the size, contour, skin detail, texture, color, color of hair and skin blemishes of the part to be replaced. As much care is given to the selection of methods of attaching the parts. Prosthesis makers try to eliminate cumbersome, complicated methods of keeping the appliances in place.

Application Methods

Arms, hands, fingers and other extremities slip on like gloves and are kept in place by suction. The separation line can be concealed with a bracelet, ring or wrist watch. As mentioned previously, facial prostheses, or parts in which the stumps are inadequate, such as the fingers, are held in place with adhesives.

In summary then, the basic problem is to construct a part which will enable the disfigured individual to rehabilitate himself to society functionally and emotionally. In order to do this the part provided must be comfortable, must stay in place securely and must not be noticeable. Used in this application, adhesives must provide security; be non-toxic and non-irritating; strong; flexible; easily removed; and must be compatible with the prosthetic material.

Adhesives Used

Adhesives in current use include a proprietary adhesive formulation produced by H. D. Justi; Davol Cream Adhesive; Padget-Hood Dermatone Cement; Adhesive A-2; Experimental Adhesive 8H; and Best Test Paper (White Rubber) Cement.

It has been repeatedly stressed that the adhesives industry is a growing field. Industrial advances made possible by its growth are demonstrated daily in the buildings now under construction and the airplanes being designed. In the prosthetics field, adhesives also perform a service, a humane and useful service. It is becoming increasingly apparent that the use of adhesives on the human body will eventually make for a major market for the adhesives manufacturer.

Note: H. D. Justi adhesive formulation is produced by H. D. Justi, Philadelphia, Penna.; Davol Cream Adhesive, by Davol Rubber Co., Providence, R. I.; Padget-Hood Dermatone Cement, by Kansas City Assemblage Co., Kansas City, Mo.; Adhesive A-2, by Johnson and Johnson, New Brunswick, N. J.; Experimental Adhesive 8H, by Rubber and Asbestos Corp., Bloomfield, N. J.; and Best Test Paper (White Rubber) Cement, by Union Rubber and Asbestos Co., Trenton, N. J.

Requirements for Prosthetic Adhesives

- **The adherent should be either a liquid or a light viscosity paste for easy application and removal by the patient.**
- **Both the solvent and the dissolved materials should be non-injurious and non-toxic to the tissues.**
- **The adhesive should set-up in contact with skin in less than five minutes following application.**
- **The set adherent should be moisture resistant so as to be little affected by saliva and other body secretions from the area of the prosthesis.**
- **The set adhesive should have some elastic quality to allow for natural skin movement beneath the prosthesis.**
- **Easy removal of the prosthesis by the patient should be permitted by the adherent.**
- **The color of the adhesive should be somewhere between a clear and a skin-tone.**
- **The material should be readily removable with alcohol or alcohol ether. Most other solvents would be injurious to the skin with continuous use.**
- **The adherent should be able to retain the average facial prosthesis from 24 to 48 hours.**
- **The adhesive solvent should not tend to adversely affect, or extract any great portion of, the elastomer formulations used in restorative work. This would involve the basic resin, its plasticizer, and the basic or applied coloring material.**

How the Adhesive Manufacturer and User can

Eliminate Solvent Hazards

The concluding portion of this article on adhesive solvent hazards focuses attention on what can be done to eliminate the dangers of dermatitis, fire and explosion.

By **SAMUEL MOSKOWITZ**

Senior Chemical Engineer
New York Dept. of Labor

Most solvents act as primary irritants by extracting fats and fatty substances from the skin. Primary irritants will, if permitted to remain on skin for a sufficient length of time and in sufficient amounts, cause dermatitis at the point of contact with any normal skin. Some skins are more resistant than others to attacks of dermatitis-producing agents.

In the case of solvents, this is largely because of differences in skin thickness and fat content. The serious character of dermatitis can be appreciated when one learns that some two-thirds of all occupational disease claims for Workmen's Compensation in New York State are for dermatitis. Not all, of course, are caused by the action of solvents.

Dermatitis can be prevented by minimizing contact between workers and irritants. Such control may involve some change in the process or operation, isolation of the irritant, use of ventilation, and good housekeeping. Personal cleanliness is probably as important a factor as any other. Adequate washing facilities—a sufficient (not merely legally required) number of wash basins, hot water, a good mild detergent without harsh abrasives, and towels—should be provided. A practice which is common, but which should be forbidden, is the use of solvents for the removal of dried or moist adhesives from the skin. It is advisable to encourage cleanliness. Permitting washing up on company time will help.

Personal protective devices will help reduce contact. Impervious gloves, preferably cotton lined, may be used. If such gloves are used, they should be insoluble in the solvents involved. Protective or barrier ointments may be indicated. There are a wide variety of such ointments: some protect against solvents; others do not. In addition, one must make sure that the ointment itself will not cause dermatitis, and also that it will not cause substances which will interfere with adhesion to be transferred from the operator's fingers to the adherends.

The medical department or the first-aid kit should be ready to dispense fat-replacing ointments to those workers whose skins are dried or scaly because of the action of solvents. However, it is advisable to procure such ointments only after consultation with a physician, preferably a dermatologist.

Fire and Explosion Protection

Of the 47 most commonly used solvents in the compilation of threshold limits, only 7 are non-flammable: carbon tetrachloride, chloroform, methyl chloroform, methylene chloride, perchlorethylene, tetrachlorethane and trichloroethylene. Each of these is a chlorinated hydrocarbon. Not all chlorinated hydrocarbons are, however, non-flammable. Among the flammable chlorinated hydrocarbons are ethylene and propylene dichlorides and monochlorobenzene. All the other solvents listed, and many others not listed, are flammable. Some are more so than others, some have flash points well above ordinary room temperatures, and others have flash points below outdoor winter temperatures.

Areas in which flammable vapors are present are designated "Class I" in Article 500 of the National Electric Code. In many locations the local fire department will have rules or codes which regulate construction, electrical equipment, storage, transfer, and other factors in connection with the use and handling of flammable liquids. In other locations, Labor Department or even Health Department rules may control. In the absence of specific rules by local government agencies, or even if such rules are in existence but are less rigid, the National Electric Code should be followed to assure the minimum degree of safety required for continuous operation.

The rules of the National Electric Code and codes of the National Fire Protection Association should be followed wherever applicable. These codes now make up six good sized volumes and are, therefore, too detailed to list here. Needless to say, these should be consulted, as well as local authorities, before installations are designed and built. For example, so called vapor-proof electric lights should not be used as substitutes for explosion-proof light housings and conduit.

Figure V is added as a reminder of

Figure 5—Lack of Proper Safeguards Can Cause Fire Hazards

21 Persons Hurt
In Factory Blaze
NEW YORK (AP) — Explosions followed by rapidly-spreading flames broke out late Tuesday in a Brooklyn manufacturing plant, injuring 21 persons, five of them seriously. Three nearby

Tipsy Teetotaler

Solvent hazards occasionally take unusual forms, as witness the following.

A New York man—a sworn teetotaler, so the story goes—was getting into trouble with his wife and his boss who accused him of habitual drunkenness. He stoutly denied drinking anything that would give him a buzz.

At the point of desperation, he decided to appeal for help to local health officials. The latter soon discovered that he worked with trichloroethylene. Proper ventilation on the job promptly sobered him up.

what can occur if fire and explosion preventive methods are not followed.

It should be born in mind that vapor concentrations in plants using solvent adhesives are not always below the Lower Explosive Limit (LEL). Vapor concentrations which are below the MAC are invariably below the LEL, but concentrations for health purposes are usually measured in the breathing zones of the workers. Concentrations in such areas and average concentrations may be satisfactorily low yet be above the LEL near an object being treated with a solvent or solvent-containing material.

The same may be said about concentrations of vapors in exhaust ducts, mixing tanks, and especially drying and curing ovens and spreading machines. Because concentrations of vapors may be in the explosive range, precautions must be taken. Attention must be paid to proper construction, the use of safety cans, adequate grounding and electric bonding, and adequate ventilation.

Vapor Leakage Protection

For example, in ovens and spreading machines such as are used in doubling and in the manufacture of adhesive tape, to protect against vapor leakage, ventilation must be sufficient to maintain at all openings an inward air velocity of at least 100 feet per minute. In addition, concentration of solvent vapors within the machines must be reduced to less than 25 per cent of the LEL.

To determine whether or not this concentration is exceeded within ovens and spreading machines, one must know the composition of the solvent being evaporated, the value of the LEL at the elevated temperature within the oven or machine, and the volume of solvent being evaporated per unit of time. Spot or continuous testing for flammable vapor concentrations can be made with little difficulty. When batch ovens are used, the average concentration of vapors must be limited to ten per cent of the LEL since more rapid evaporation occurs at the start of a drying cycle.

Heated equipment must be provided with a variety of interlocks and other safety factors to prevent ignition of vapors. These can be found in Pamphlet No. 86 of the National Board of Fire Underwriters. Another factor which should not be ignored is the necessity of using non-ferrous fan blades on mixers and when ventilating flammable vapor producing equipment or premises.

It may appear that considerable care must be taken to avoid hazards to health, life, and property where solvent-containing materials are involved. This is indeed the case, and there is also no doubt that the cost is high, though not excessive. It must be considered as one of the costs of production, not an added cost which is carried to satisfy governmental requirements. Indeed, from the literature cited, it can be seen that these requirements are not only governmental; major insurance companies and safety organizations subscribe to them heartily.

There is one more situation which must be considered: what to do with solvent vapors which are exhausted from workrooms and process equipment, Air pollution is receiving more and more attention. Communities are being made aware that the atmosphere cannot continue to be looked upon as an open sewer for air-borne wastes.

Local Requirements

It is the responsibility of the industries involved to acquaint themselves with local requirements, if any, and current opinions on the subject. They must then decide whether or not the quantity of solvent vapors which may be expelled from their plants is such as would exceed present or near-future standards for permissible emissions. If the quantity is excessive, the problem of air cleaning must be considered.

Solvent vapors lend themselves readily to two different kinds of air cleaning methods: (1) adsorption and (2) combustion. The first kind involves expensive equipment, but if the quantity of solvent evaporated is large, it may pay for itself in recovered solvent.

The second method, using either catalytic or with gas-fired after burners, is less expensive initially but produces no byproducts other than heat. The latter type of air cleaning process must also be investigated from the point of view of the production of other atmospheric contaminants. If the solvents contain no elements other than carbon, hydrogen and oxygen, and combustion is reasonably complete, there is no problem.

About the Author . . .

SAMUEL MOSKOWITZ received his bachelor's degree in chemical engineering and his doctorate in chemistry from New York University. For the 23 years he has worked in the field of industrial hygiene. Most of that time he has been with the New York State Department of Labor. He has also had special appointments as a consultant for the U. S. Labor Department, a technical expert for the Point Four program in India, and an advisor for the U.N.'s International Labour Office in Israel. He frequently publishes papers on industrial hygiene.

NEWS of the

ADHESIVES WORLD

ASTM Joint Sealants Committee Holds Organizational Meeting

The American Society for Testing Materials Committee C-24 on Joint Sealants held its organization meeting on September 15 at ASTM Headquarters in Philadelphia, Penna. Sixty-six members of the new committee were in attendance. R. E. Hess (ASTM) welcomed those present and reviewed briefly the consideration which had been given by ASTM, through its board of directors, on the subject of sealants. Mr. Hess also reviewed the character of ASTM committees, noting that all committees carry on their work under their own set of bylaws which are supplemental to the general regulations of the Society. These committees are autonomous in nature and pass upon all membership matters as well as outline their own program of standardization work.

Title and Scope Discussed

Considerable discussion took place on the title and scope of the new committee. Mr. Hess pointed out that ASTM Committee D-1 on Paint, Varnish, Lacquer, and Related Products was singled out as an existing ASTM committee interested in caulking compounds but that this committee was confining its work to the oil-base types. Committee D-11 on Rubber and Rubber-Like Materials also has a definite interest in this field. With the apparent emphasis on building construction, a question was raised by Gilbert L. McGill (Martin Co.) as to whether C-24 would be concerned with standards needed by the aircraft industry. Mr. McGill pointed out that new methods of test are needed which are applicable directly to the aircraft industry. In reply, it was pointed out that the aircraft industry has been considered in the scope of C-24, and that the ASTM board approved such a new committee rather than an assignment to an existing committee on the basis that it would be broader than any one particular industry.

The question of limiting the activities of the committee to the elastomeric type of sealant was raised. This question led to a request for a definition of elastomeric. The definition of elastomer, as developed by Committee D-11, was stated as "A substance that can be stretched at room temperature to at least twice its original length and, after having been stretched and the stress removed, returns with force to approximately its original length in a short time." The group realized that there are many sealants in use which do not fit the definition of the term elastomeric, and the question was brought up as to whether consideration be given only to sealants used for joints. It was the general consensus that the field would be too wide to include all types of sealants and that the criteria should be aimed at the end use. Following general discussion, a motion was made and passed that the title of the new committee be Committee C-24 on Joint Sealants. Up to this point the committee had been listed under the temporary title of Committee C-24 on Elastomeric Sealants.

In the discussion of the scope of the committee, it was pointed out that with a broad title, the scope should also be broad. However, the scope can be narrowed as the committee sees fit and the functional approach was stressed. After general discussion and in recognition of the desire to include the aircraft industry as well as other types of construction and highway industries, the group passed upon the following to be the scope of Committee C-24 on Joint Sealants: "The promotion of knowledge, stimulation or research, and the development of methods of tests, specifications and nomenclature of

Wayne Koppes
Elected C-24 Chairman

materials for sealing joints and openings. Such sealants include caulking and glazing compounds and preformed gaskets and tapes. These activities will be coordinated with those of other relevant committees of ASTM."

With the title and scope of the committee firmly established, the group proceeded to nominate and elect the following permanent officers. *Chairman,* Wayne F. Koppes (Architectural Consultant); *Vice-Chairman,* Roger K. Humke (Minnesota Mining & Mfg.); *Secretary,* J. R. Panek (Thiokol); and *Membership Secretary,* H. F. Kleinhans (Pawling Rubber).

Pending the formulation of by-laws for the committee, the group authorized the elected officers and the steering committee to act as the Temporary Executive Subcommittee. The steering committee, under the chairmanship of D. E. Parsons (National Bureau of Standards), had been appointed by the ASTM board during the preliminary planning session in May. The committee includes J. R. Panek (Thiokol), representing Committee D-11; G. J. Schulte (Minnesota Mining & Mfg.), representing the Rubber & Plastic Adhesives and Sealants Manufacturers Council; Wayne Koppes (Architectural Consultant); T. P. Martin (Pittsburgh Plate Glass); and Harry Kelfer (Sterling Quality Products), representing Committee D-1. Two additional representatives were added to the steering committee: W. J. La Fleur (New York State Thruway Authority), representing highway interests, and G. L. McGill (Martin), representing the aircraft industry.

In considering the working subcommittees of Committee C-24, L. C. Gilbert (ASTM) outlined to the group the typical types of committee organization which are presently in use in ASTM. He pointed out that the most simple type consists of subcommittees on nomenclature, specifications and methods of tests. Expansion into further groups can be made from these basic types of subcommittees. Following a discussion, motions were made and passed to authorize the organization of three subcommittees, these being Nomenclature, Bulk Compounds, and Gaskets and Tapes.

The group gave the Temporary Executive Committee the power to schedule the next meeting of C-24 which may be held during the 1960 ASTM Committee Week meeting in Chicago, Ill., on February 1-5.

R. L. Hawkins

Hawkins Joins Colton

R. L. Hawkins has joined the Technical Service Laboratories of Colton Chemical Co., a division of Air Reduction Co., Inc., Cleveland, Ohio, to handle technical service for polyvinyl alcohol. Before joining Colton, Mr. Hawkins was with the Southern Adhesives Corp., Union Paste Co. and Special Products Corp. He holds patents on adhesives using polyvinyl alcohol and has extensive experience in solid fiber laminations, coatings and adhesives. Mr. Hawkins was graduated from Duke University with a degree in chemistry and did graduate work at the University of Richmond.

Coffin Joins Borden

Arthur A. Coffin, specialist in paper chemistry, has been named a consultant for the Borden Chemical Co., New York, N. Y. Recently retired from the Titanium Pigment Corp., a division of the National Lead Co., which he served for 29 years, Mr. Coffin is considered one of the nation's top authorities in the paper industry. He will work with paper manufacturers on applications of the company's full line of synthetic resins and latices. These include butadiene-styrene, acrylic, polyvinyl acetate, polyvinyl alcohol, and other emulsions.

New Adhesives Plant

Morgan Adhesives Co., a subsidiary of Bemis Bros. Bag Co., Boston, Mass., has announced that production has begun at its new plant in Stow, Ohio. According to the company, the fully automated $300,000 plant will produce a variety of gum-backed labels for use in advertising and industry.

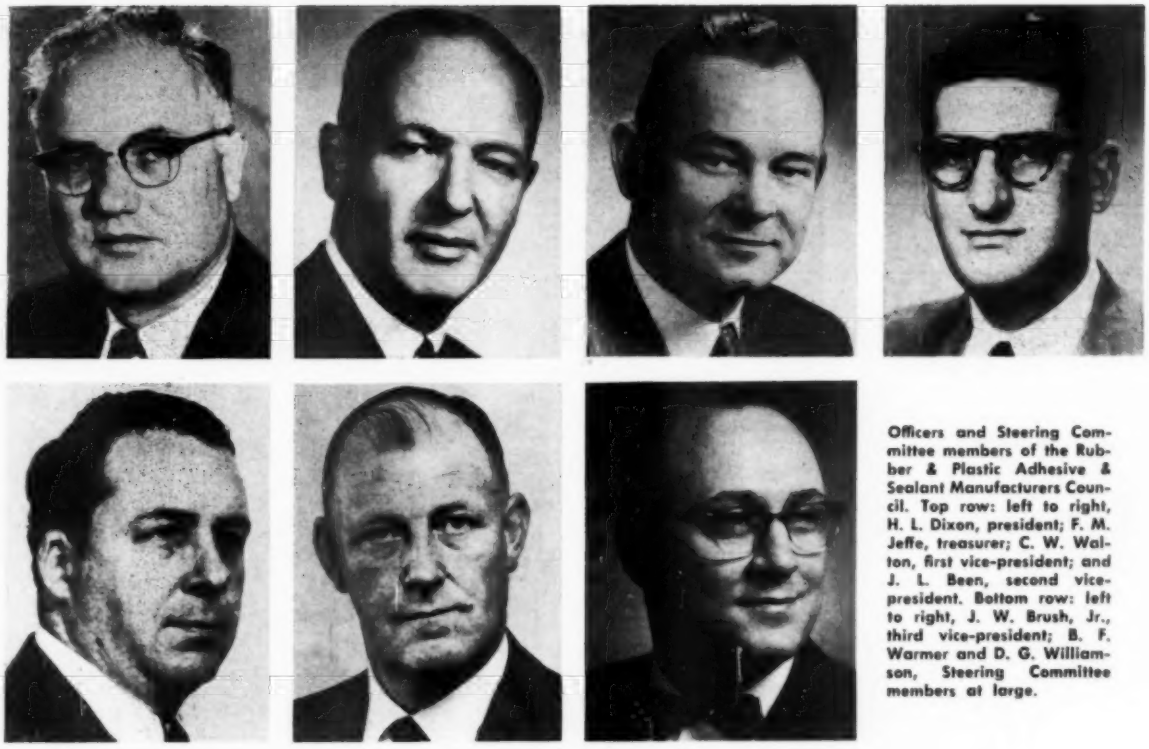
BRI Meeting Discusses Curtain Wall Design

A two-day conference on "Design Potential of Metal Curtain Wall" will be one of the featured meetings during the Fall Conferences of the Building Research Institute, which will be held on November 17 to 19 at the Shoreham Hotel, Washington, D.C. The curtain wall sessions, which will be held on November 18 and 19, will be presented by a joint BRI-American Institute of Architects planning committee, and sponsored by the Metal Curtain Wall Division of the National Association of Architectural Metal Manufacturers.

George P. Danforth (Illinois Institute of Technology) will be the conference chairman for the curtain wall session and his opening remarks will be on the "Challenge of Metal Curtain Walls." Architects participating in the first session will include Graham, Anderson, Probst & White, who designed the Morton Salt Company building in Chicago, Ill.; Sidney J. Folse of Curtis and Davis Associates, who designed the New Orleans (La.) Public Library; and Robert C. Dean of Perry, Shaw, Hepburn & Dean, the firm which designed the Sheraton Hotel in Philadelphia, Penna. The selected buildings will be introduced as case studies to consolidate recent experience.

The final curtain wall session, on "Creative Design of Metal Curtain Walls," will be held on November 19. Papers to be presented at this meeting will include "Fabrication Possibilities and Tolerances" by J. M. Roehm (Kawneer); "Design for Efficient Field Erection" by Norman S. Collyer (F. H. Sparks Co.); "Color and Finish Control with Ferrous Metals" by Joseph P. Butterfield (Armco Steel); "Color and Finish Control with Non-Ferrous Metals" by C. J. Walton (ALCOA); "Architectural Control of Fabrication and Erection" by Alfred S. Alschuler, Jr. (Friedman, Alschuler & Sincere); "New Metal Curtain Wall Specification" by Ralph L. McKenzie (Architectural Metal Manufacturers Assn.); and "Approaches to Architectural Design With Metal" by a speaker to be announced at a later date.

Subjects for other sections which will be held concurrently during the three-day conferences will include Sandwich Panel Design; Modular Coordination; New Heating Techniques; and there will be workshops on building research.



Officers and Steering Committee members of the Rubber & Plastic Adhesive & Sealant Manufacturers Council. Top row: left to right, H. L. Dixon, president; F. M. Jeffe, treasurer; C. W. Walton, first vice-president; and J. L. Been, second vice-president. Bottom row: left to right, J. W. Brush, Jr., third vice-president; B. F. Warmer and D. G. Williamson, Steering Committee members at large.

Adhesive Council Elects 1960 Officers

Rubber & Plastic Adhesive & Sealant Manufacturers Council, Chicago, Ill., has announced that Henry L. Dixon (B. F. Goodrich) was re-elected president of the Council during its annual meeting on September 24 and 25 at the Hotel Stuyvesant in Buffalo, N.Y. Also elected to serve as officers of the Council for the term ending September 30, 1960 were: *Treasurer,* Francis M. Jeffe (Pierce & Stevens); *First Vice-President,* Charles W. Walton (Minnesota Mining); *Second Vice-President,* Jerome L. Been (Rubber & Asbestos); and *Third Vice-President,* Jerome W. Brush, Jr. (Raybestos-Manhattan). The five officers will also serve on the Steering Committee, which includes B. F. Warmer (Coast Pro-Seal) and D. G. Williamson (Williamson Adhesives).

Henry L. Dixon is general manager of adhesive products for B. F. Goodrich Industrial Products Co., Cleveland, Ohio, a division of the B. F. Goodrich Co., Akron, Ohio. He is a chemical engineering graduate of Simmons University and received his master's degree from Yale University. He joined Goodrich in 1934 and was named manager of reclaim manufacturing in 1943. In 1945, Mr. Dixon was appointed production manager of the Industrial Products Division.

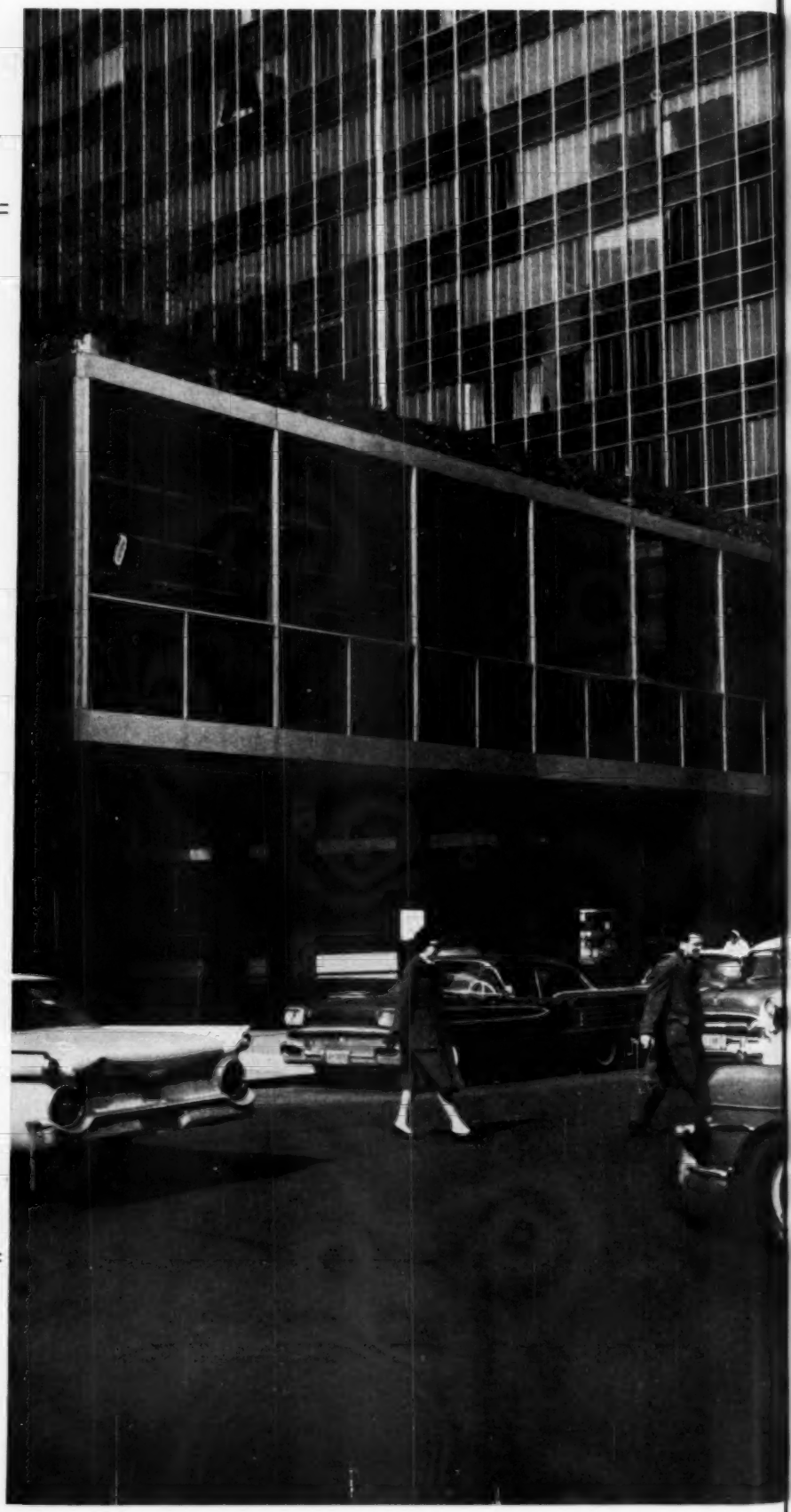
Francis M. Jeffe is vice-president of the Industrial Division for Pierce & Stevens Chemical Corp., Buffalo, N.Y. He graduated from Syracuse University in 1934. In the 24 years that Mr. Jeffe has been associated with Pierce & Stevens, he has been closely associated with the company's progress in adhesives. He is presently responsible for the company's research and production facilities to the adhesive needs of the paper, glass, leather, plastics and rubber industries.

Charles W. Walton is vice-president of the Adhesives, Coatings and Sealers Division of Minnesota Mining & Manufacturing Co., St. Paul, Minn. He received his B.S. degree in 1930 from the University of Illinois; his M.S. degree in 1931 from the University of Michigan; and his Ph.D. in 1933 from the University of Michigan. Prior to joining 3M in 1947, Mr. Walton had been with the Goodyear Tire & Rubber Co. Mr. Walton's assignments at 3M have included service as assistant to the executive vice-president; general manager of the New Products Division; and general manager of the Adhesives & Coatings Division.

Jerome L. Been, executive vice-president of Rubber & Asbestos Corp., Bloomfield, N.J., received his B.S. degree in chemical engineering in 1940 from City College of New York, and did graduate work at the Polytechnic Institute of Brooklyn and George Washington University. He previously was employed as a materials engineer by the United States Maritime Commission, working on paints, adhesives, coatings and plastic materials used in ship construction. He joined Rubber & Asbestos in 1946.

Jerome W. Brush, Jr. is manager of the Adhesive Department of Raybestos-Manhattan, Inc., Bridgeport, Conn. He joined the company in 1941 and was associated with the Automotive Replacement Sales Department. At various times, he held such posts as assistant sales manager, merchandising manager and rubber products manager. Prior to assuming his present post, Mr. Brush was assistant director of marketing and merchandising for the company.

HOW MANY MARKETS* FOR INDUSTRIAL ADHESIVES CAN YOU SEE IN THIS PICTURE ?



* ***This photo spotlights 10 major adhesives markets:*** *Number one, of course, is the exciting new curtain wall construction of the building. In addition are the many automotive and apparel applications. Hidden from view in the building are many other uses. For example, air conditioning, floor coverings, furniture, office appliances and equipment. (Even the dent in the car will be repaired with an adhesive-bonded metallic compound!)*

YOU CAN REACH THEM ALL AS A SINGLE GREAT MARKET IN ADHESIVES AGE

Today, there are adhesives in practically every product you see. And great and growing sales opportunities for you if you sell industrial adhesives or adhesive products—or the materials, machinery, supplies, equipment, services used in making, shipping, storing or applying adhesives!

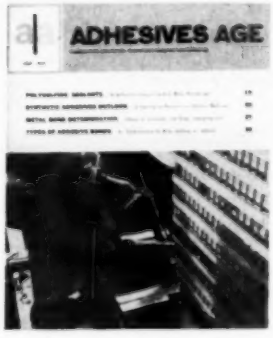
For in industry after industry, profit-minded manufacturers are using adhesives in increasing quantities: to cut costs . . . speed production . . . save labor . . . improve products. And—with new developments in adhesive chemistry and technology, production techniques, handling and application occurring almost daily—adhesives are literally *creating* revolutionary new products . . . unheard-of manufacturing processes.

And now this industry-spanning, economy-wide market is bonded together into a single, sellable unit. By Adhesives Age! The only magazine devoted specifically and exclusively to the specialized problems of adhesives: manufacture, research, development, technology, application, storage, marketing and sales.

That is why Adhesives Age can take your story to the entire adhesives market—companies that use adhesives in their own production and packaging, or re-sell them in conjunction with their products . . . all types of adhesives manufacturers . . . suppliers of materials, equipment and services for the application, packaging, production and transportation of adhesives.

Here—in Adhesives Age—is a big, new market; yours for the selling!

PALMERTON PUBLISHING CO., INC.
101 WEST 31st ST., NEW YORK, N. Y.



FACTS ABOUT THE ADHESIVES MARKET

- A multi-million-dollar-a-year industry—and growing fast!
- Covers over 40 major adhesives consuming industries.
- Annually consumes several million pounds of nine basic types of adhesives: thermosetting synthetic resin, thermoplastic synthetic resin, natural and synthetic rubber, cellulose and starch, natural resin and oil, water-soluble gum, animal or fish origin materials, protein and derivatives, inorganic compounds.
- Researched for Adhesives Age by Mills Shepard . . . with comprehensive readership reports available on editorial and advertising.
- Covered by Adhesives Age's 10,000 circulation among men in carefully selected major user companies—and adhesives manufacturers.
- A full page, every-month schedule in Adhesives Age costs only $4,200 for an entire year—$350 a page.

For more facts about this important growth market and the only publication edited to serve it, call your Adhesives Age representative or fill out and mail this coupon.

ADHESIVES AGE
101 West 31st St., New York 1, N. Y.

I'm interested. Please send:

- ☐ Adhesives Age—Market and Magazine
- ☐ Adhesives Age Fact File
- ☐ Readership Study #1

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Presstite Seals Roof of Las Vegas Center

Presstite Division of the American-Marietta Co., St. Louis, Mo., recently completed weatherproofing the structural steel aluminum covered roof structure of the $6 million Las Vegas Convention Center in Las Vegas, Nev. The Center's mushroom dome, which can be seen for miles across the flat desert, is formed by 16 steel trusses and its surface is constructed of anodized aluminum. The unusual roof measures 316 feet in diameter and has a 90 foot crown. It is made of .040 x 4 inch rib, box corrugated Reynolds aluminum, and over 1,000 squares were used in the roofing construction assembly. The dome will be specially lighted at night for dramatic effect.

Weatherproofing was accomplished with the use of Presstite No. 579.63 and No. 1175.15 sealers. All laps on the roof were sealed both lengthwise and across the ends with Presstite No. 579.63 Non-Drying Mastic, gray ¼ inch bead. All fasteners, 75,000 of them, were cap-sealed with Presstite No. 1175.15 Polysulfide Rubber Base Sealing Compound, aluminum color. In many cases, the fasteners were driven through a bead of the No. 579.63 Mastic. The installation was made at a time of extreme temperatures, 115° to 125°F. For this reason, Presstite No. 1175.15 was mixed in a shop, placed in disposable polyethylene cartridges and frozen. The filled cartridges were delivered to the job in a chest of dry ice. As the material was needed, the cartridges were placed in a Semco Sealant Gun for immediate application. Due to the high temperatures, the No. 1175.15 cured in about 15 to 20 minutes.

The Las Vegas Convention Center is the first phase of a large civic project to develop Las Vegas as an important business community as well as a national resort attraction. It measures 440 feet across, including an outer concourse where display facilities and exhibit areas are located. The over-all length of the building, including the exhibit wing is 1,000 feet with a total area of 275,285 square feet. The Center will seat 8,500 people in the assembly hall and 7,500 persons for such events as horse shows, ice shows, ice hockey, boxing, etc. The building's facilities include 20 meeting rooms, two catering kitchens capable of serving 3,000 people, two portable stages, all completely air conditioned. A portion of the walls are of masonry curtain wall construction with some portions veneered with textured Spanish tile.

Forms Two Departments

Food Machinery and Chemical Corp., New York, N. Y., has announced that expanding interest in its Dapon (diallyl phthalate) resin and epoxy resins and chemicals has led to the formation of two new departments to produce and market these products. The Dapon Department will be headed by Robert H. Malott, formerly manager of planning and control for the firm's Organic Chemicals Department. He will be assisted by Jack L. Shafer, recently vice-president of sales for the Tensolite Insulated Wire Co., Inc. Richard M. McFarland, formerly FMC's plastics product manager will join the new Dapon Department. Kenneth H. Wanderer, previously controller of FMC's Chemical Divisions, will head the new Epoxy Department, while Dr. Frank P. Greenspan will serve as technical director. Dr. Greenspan, a recognized authority in the chemistry of epoxides, formerly served as director of development for the company's Chemicals and Plastics Division.

Airco Vinal Fiber

Air Reduction Chemical Co., New York, N. Y., is now using the generic term vinal to identify the synthetic fibers of polyvinyl alcohol, which are marketed by the company's Fiber Department. The company, a division of Air Reduction Co., Inc., is developing the United States market for a fiber known abroad as vinylon. Polyvinyl alcohol fibers are used extensively in Japan for a wide range of textile products including school uniforms, industrial fabrics and many others.

Under the Textile Fiber Products Identification Act vinal is described as a synthetic fiber of at least 50 per cent PVOH units and at least 85 per cent total alcohol and acetal units. The act, which goes into effect March 3, 1960, requires labeling of certain textile products to show fiber composition. As the United States supplier of polyvinyl alcohol fibers, Airco is now putting into immediate use the approved generic name, vinal, for all applications.

Record Sales Forecast For Liquid Adhesives

A new peak in retail sales of liquid plastic fillers, sealants and adhesives was envisioned by Victor Gelb, vice-president of sales for Woodhill Chemical Co. Mr. Gelb predicted that aggressive marketing and the do-it-yourself vogue would help push sales to the $30 million mark this year, while next year's volume would increase even further to $35 to $45 million.

According to Mr. Gelb, the fastest growing item is liquid aluminum. Other popular products include plastic rubber, plastic porcelain, and repair materials for vinyl plastic items such as vinyl seat covers and vinyl air cushions. He said that development of these new products and the growing number of firms interested in entering the field are making more liquid plastic materials available to the consumer.

Taking his own company as an example of the optimistic sales picture, Mr. Gelb reported a tenfold increase in the sales of Woodhill Chemical during the past five years. Expected sales this year should total over $2 million, while in 1954 sales were only $200,000. Other companies benefiting from the upswing are Devcon, Borden, LePage's, Major Iron Cement Co. and Carters Ink Co., he said.

The resins used in the manufacture of the various plastic adhesives range from epoxies to polyesters. Vinyls continue to be the major resins, Mr. Gelb noted, but epoxy resins are growing steadily. Acrylic resins are also being used. The solvents used are generally of the ketone type, while atomized metals constitute the fillers.

Mr. Gelb said that the major retail outlets for plastic adhesives, sealants and fillers are supermarkets, hardware and paint stores and auto supply stores.

New Shawinigan Resin

Shawinigan Resins Corp., Springfield, Mass., is now producing a new borax stable polyvinyl acetate-dibutyl maleate copolymer emulsion, tradenamed Resin D-243. The emulsion is said to combine borax tolerance with a high degree of compatibility with organic solvents. It is designed for use in adhesives, textile finishing, as a cement additive, in paper coatings, surface coatings, and as a beater additive in paper manufacture, the company states.

Continuous Epoxidation

"A Novel, Continuous, Countercurrent Epoxidation Process" was described at a meeting of the American Oil Chemists Society in Los Angeles, Calif., on September 30, by Dr. H. K. Latourette of the Inorganic Chemicals Research and Development Dept., Food Machinery and Chemical Corp., Princeton, N.J. H. M. Castrantas, R. J. Gall and L. H. Dierdorff were co-authors of the paper that presented the latest results of a ten-year research program into epoxidation technology.

The new process, said to be ready for pilot scale development, utilizes an unsaturated oil (such as soybean oil), an inorganic acid and hydrogen peroxide. These are introduced countercurrently into the top of a packed column and the resultant epoxidized products and spent reagents removed continuously at the other end. Dr. Latourette reported that the process, when scaled up to commercial size, promises increased time-volume productivity, higher yields and greater purity than are obtainable by conventional batch methods.

Epoxidized products find applications as plasticizers and stabilizers for vinyl resins, resin intermediates, rubber modifiers, reactive diluents, acid scavengers, insecticides, and in protective coatings and textile finishes. Epoxy plasticizers, Dr. Latourette said, alone command a 35 million pound per year market, which is expected to double within the next five years.

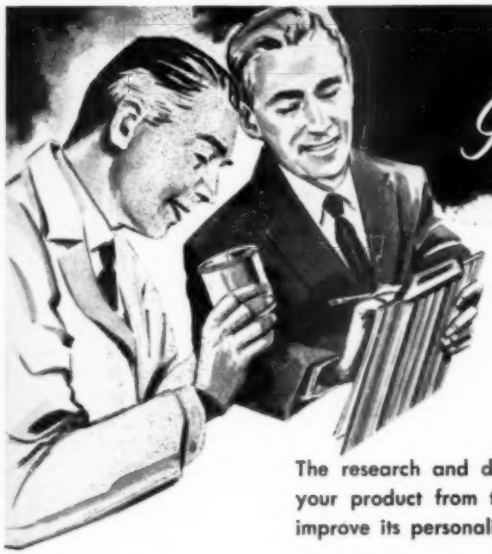
BRI Conference

The Building Research Institute of the National Academy of Sciences-National Research Council has announced that the first of its new multi-subject conferences will be held on November 16-19 in Washington, D.C., at the Shoreham Hotel. The Institute reports that already scheduled are discussions and full-scale workshop sessions on sandwich panel design, architectural metal curtain walls, building research in the United States and overseas, and the problems of manufacturers whose products are used in component construction. Chairman of the conference will be Thomas E. Werkema, industrial research analyst for Dow Chemical Co., and Dr. Albert Dietz of Massachusetts Institute of Technology will head up the sessions on "Sandwich Panel Design Criteria."

Develops Cyclobutanes

Eastman Chemical Products, Inc., Kingsport, Tenn., has introduced what is said to be an economically feasible production method for cyclobutane derivates which make these compounds available for commercial research and development for the first time. The two compounds released in development quantities are tetramethyl-1,3-cyclobutanedione and its reduction product 2,2,4,4,-tetramethyl-1,3-cyclobutanediol. The breakthrough was achieved by preparation of dimethyl ketene by a process whose details have not been disclosed pending patent approvals.

The ketene dimerizes readily to provide the dione which, in turn, yields the corresponding diole through catalytic hydrogenation. The dione is said to have typical diketone reactions, also reacting with carbonyl group reagents to form heterocyclic derivatives of interest in the photographic and dye fields. The cyclobutanediol derivates that the company has designated of special interest are the esters and polyesters. Because of their great thermal and hydrolytic stability, they may find use in the plasticizer field, as well as providing a base for urethane derivatives.



Improve product personality

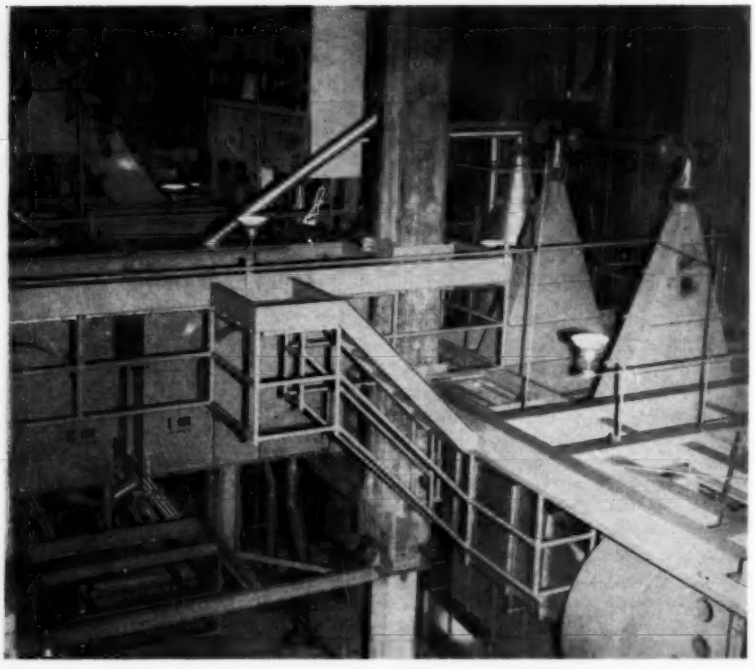
WITH ODOR CONTROL

The discreet suggestion of a pleasant odor can effect a marked improvement in the sales acceptance of your product. Through the modern techniques of scientific odor control, scent becomes an important plus factor in sales appeal and brand loyalty for your product.

The research and development laboratories of van Ameringen-Haebler will evaluate your product from the point of view of scent and suggest an aromatic additive to improve its personality.

van Ameringen-Haebler *division of*
INTERNATIONAL FLAVORS & FRAGRANCES INC.
521 West 57th Street • New York 19, New York
Leading creators and manufacturers in the world of fragrance

ARGENTINA AUSTRIA BELGIUM BRAZIL CANADA ENGLAND FRANCE GERMANY
HOLLAND INDONESIA ITALY NORWAY SOUTH AFRICA SWEDEN SWITZERLAND



Armour Alliance Industries' new plant for automatic manufacture of soluble dried blood for adhesives, located at South St. Paul, Minn. The evaporators are at the upper left of the photograph. Blending boxes numbered 1 and 2 help to provide uniform consistency in the product. Dials on the control panel in the center of the photograph, are set to make products meeting different specifications.

Armour Alliance Opens Dried Blood Plant

Armour and Co., Chicago, Ill., has announced that its division, Armour Alliance Industries, has opened a new soluble dried blood plant at South St. Paul, Minn. According to Armour, the product, used in making adhesives and for other purposes, can now be made according to exacting specifications of manufacturers. Annual production of the completely automated plant is expected to be several million pounds. The company reports that different users require soluble dried blood with different degrees of water solubility and alkaline solubility. By refrigerating the blood from meat animals, and then processing it rapidly in stainless steel equipment, a degree of quality control is obtained which has never been achieved before, the company states.

According to Armour, the chief users of the adhesives which are made from soluble dried blood are Douglas fir plywood manufacturers on the West Coast, but other uses are rapidly developing, such as veneering, quality wooden musical instruments, particle board and cork products. Soluble dried blood is also used as protective colloids, in rubber manufacturing, amino acid production, paper flocculants and sizes.

Forms New Departments

Food Machinery and Chemical Corp., New York, N. Y., has announced the formation of two new departments to manufacture and distribute diallyl phthalate (Dapon) and epoxy resins. The Dapon Department will be headed by Robert Malott, the Epoxy Department by Kenneth Wanderer. The new units are being organized by the company's Chemicals and Plastics Divisions.

Armour Appoints Two

Armour Alliance Industries, Alliance, Ohio, has appointed Thomas D. Harrold and Robert R. Keafer as sales trainees in its Adhesives Division. Mr. Harrold will cover Pennsylvania and Mr. Keafer will service an Ohio territory. Mr. Harrold is a recent graduate from Kent State University, and Mr. Keafer previously was a sales representative for the Sunshine Biscuit Co.

Minnesota Mining Wins Injunction

Minnesota Mining and Manufacturing Co., Minneapolis, Minn., recently won an injunction in State Supreme Court in New York against the use by other corporations of its secret processes in the production of Scotch Tapes. Damages were awarded for infringements since 1951. The defendants were the Technical Tape Corp., of New York and New Rochelle; the Vernon Chemical and Manufacturing Co., an affiliate; Paul Cohen and Paul Shalita, officers of the firms; and Frederick C. Beyer, a chemical engineer.

According to Justice Arthur D. Brennan, Mr. Beyer had been associated with Minnesota Mining, serving in various laboratories from 1945 to 1951. Formulas used for making masking and cellophane Scotch Tapes were so secret that the details were kept in separate books, none of which gave a comprehensible formula, he said. Mr. Beyer had access to all the books, he found.

The cost of developing the formulas between 1934 and 1945 was placed by witnesses at $3,500,000. Justice Brennan said Mr. Beyer was induced to join Technical Tape, and the cellophane tapes of that firm immediately improved in quality and sales. In granting an injunction against further infringements of Minnesota Mining's trade secrets, Justice Brennan directed that a referee determine damages.

Synthetic Resins Plant

American-Marietta Co., Seattle, Wash., has announced plans to build a synthetic resins plant in North Richmond, Calif. The company reports that the plant will produce 28 million pounds of resin a year, with full production scheduled for 1962. This new plant will be the sixth in the company's Adhesive, Resin and Chemical Division. Resins to be made when production begins are phenol-formaldehyde, urea-formaldehyde, resorcinol-formaldehyde and modified resorcinol, and melamine-formaldehyde.

Acquires Two Firms

Morningstar-Paisley, Inc., New York, N. Y., has acquired the San Luis Valley Starch Co. and the Monte Vista Sales Co., both of Colorado. Robert H. Detweiler will continue as manager of the starch plant, which he founded.

Conference Held on Adhesive Marketing

A conference dealing with progress in the marketing and application of plastic adhesives, co-sponsored by U.S. Rubber Co., New York, N.Y., and Schwartz Chemical Co., Long Island City, N.Y., was held on September 16 at the Hotel Roosevelt, New York, N.Y. Speakers at the conference were Charles P. Creamer, manager of adhesives sales for U.S. Rubber, and A. A. Schwartz, president of Schwartz Chemical.

In discussing the progress being made in rubber base adhesives, Mr. Creamer predicted that the volume of sales for all types of liquid adhesives should zoom close to a billion dollars in 1960. Mr. Creamer based his projection on a half billion dollar market for plastic and rubber base adhesives and an equal market for other liquid adhesives. According to Mr. Creamer, one of the greatest single potential markets for solvent adhesives is found in automobile manufacture in which demand has increased steadily for five years.

Another substantial market cited by Mr. Creamer was the aircraft industry. He pointed out that adhesives experts claim that the day is almost here when adhesives will replace most, if not all, of the welded parts in many types of aircraft. Mr. Creamer also reported a change from multiple product sales to direct selling and distributor sales. He cited the recent appointment of Schwartz Chemical Co. as a distributor for U.S. Rubber's adhesives as a forward step toward broadening merchandising operation through franchised distributors of U.S. Royal Adhesives.

Mr. Schwartz remarked that his company has developed products for specific needs of the plastics industry. They include a wide variety for cementing plastics to plastics and plastics to dissimilar materials. Mr. Schwartz pointed out that as a result of the association with U.S. Rubber, dozens of proven rubber adhesives have been added to the Schwartz Chemical line. It is planned to round out the line with epoxies, polyesters and polyurethanes, Mr. Schwartz stated.

Clifton Moves Plant

Clifton Adhesive Co., has moved its plant and offices to larger quarters. The company's new location is Burgess Place, Mountain View, Wayne, N. J.

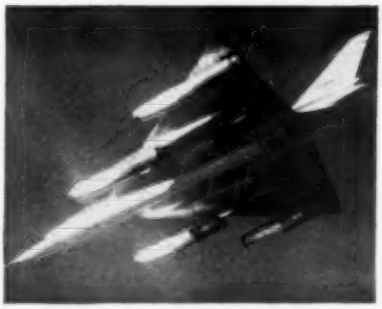
B.F.Goodrich

Over 200 kinds of adhesives

TODAY, B.F.Goodrich makes over 200 kinds of adhesives. Most of these are in regular use in one or more of our customers' plants. Some are tailored to specific jobs, others cover a range of many applications.

Adhesives made by B.F.Goodrich will bond almost any materials you can name—joining them to themselves or each other. Sometimes, adhesive bonding is the only practical method of fastening. In other cases, adhesives often have special advantages—high strength, less weight, lower cost or greater freedom of design.

Brake linings, supersonic planes, helicopter rotor blades, curtain walls for buildings, for example, have all proven to be stronger, safer when bonded together with B.F.Goodrich adhesives. High-strength adhesives took the place of 500,000 rivets in the B-58 supersonic bomber (picture).



Each month, perhaps a dozen new formulations join the ranks of our adhesives as we work with industry to find ways to improve product design and production techniques. Here are some recent examples:

B.F.Goodrich has perfected an adhesive that permits vinyl-coated sheet steel to be deep-drawn—stretched as much as 35 per cent without weakening the bond or damaging the coating.

Two new adhesives have been developed by B.F.Goodrich for bonding polystyrene foam. One is ideal for use with foamed-in place polystyrene. The other is recommended for bonding pre-foamed polystyrene shapes to themselves or to steel, aluminum, formica and other materials.

For bonding some materials that in the past stubbornly refused to stick together, B.F.Goodrich has a new group of rubber-like adhesives. Synthetic films, such as nylon, polyethylene and cellophane can now be bonded to all kinds of metal as well as to paper, wood, glass, foils and plastics.

With so many stock adhesives to choose from, and so many other special ones possible, it may be a problem to find the best one. You can get more information by writing to B.F.Goodrich.

When you write, give details. It's surprising how often small details help us recommend the one adhesive that does the job.

How will you apply the adhesive? Spray, roller coat, extrusion or brush? What materials are to be joined? Can heat and pressure be used? Any temperature limitations? Method of assembly (present or proposed)? Is metal used? If so, how is the metal pretreated?

How strong must the bond be? Must it have heat resistance? How much? Chemical resistance? Are there any requirements for taste, odor, toxicity, color? Any other requirements?

Just write to *Department M-726, B.F.Goodrich Industrial Products Co., Akron 18, Ohio.*

B.F.Goodrich ***industrial adhesives***

Symposium on Industrial Adhesives Held at University of Wisconsin

The Engineering Institutes of the University of Wisconsin, Madison, Wisc., in cooperation with the Glues and Gluing Division of Forest Products Research Society and U.S. Forest Products Laboratory, held its first symposium on Industrial Adhesives Application on October 1 and 2, at the Wisconsin Center Building, University of Wisconsin, Madison, Wisc. The two-day program consisted of 12 speakers from the industry and the Forest Products Laboratory who covered such subjects as "Designing With Adhesives"; "Adhesives in the Wood and Paper Industries"; "Adhesive Fabrication of Metals and Plastics"; "Quality Control Problems in Adhesive Bonding"; "The Future for Future Adhesives"; "New Glued Wood Products"; and "Trouble Shooting Adhesive Bonds."

Presiding over the first day's session, attended by 90 persons, was Richard F. Blomquist (U.S. Forest Products Laboratory). In his introductory remarks, Mr. Blomquist discussed some general points as to why there has been an increase in the use of adhesives for industrial purposes. He stressed such factors as new base components; greater background knowledge of bonding processes; better technical service; acceptance of technical help by users; better quality control; tough military requirements being met; good service experience with bonded products; and the increasing confidence of the general public.

Mr. Blomquist then introduced the first speaker, A. J. Slosser (Armstrong Cork), whose topic was "Designing With Adhesives." Mr. Slosser stated that during the past 10 to 15 years, the development of new adhesives with improved properties has proceeded at a gratifying rate. Impetus to the development of new products during this period has been supplied by the acceptance of adhesives as reliable means of attachment and the need for adhesives with better properties. Mr. Slosser pointed out that the constant quest for new adhesives to perform under conditions ever-increasing in severity, implies that they are satisfactory under less severe conditions and there must be some reasons for preference of adhesives over other means of attachment. He then explained why adhesives are used, and how to derive the maximum benefits from the good properties of adhesives and to minimize the effect of the shortcomings or weak points in the design of adhesive joints.

Five speakers participated in the session on "Adhesives in the Wood and Paper Industries." They were: Leonard A. Ropella (Roddis Plywood), "Plywood and Doors"; Maurice J. Rhude (Unit Structures), "Structural Glued Laminated Timber Adhesives"; Isaac Sheppard, Jr., speaking for Willard J. Worth (National Homes), "Adhesives in the Housing Industry"; John W. Maxwell (Borden Chemical Co.), "Adhesives used for Particle Board"; and Richard E. Smith (H. B. Fuller Co.) "Paper and Fiberboard Adhesive Applications."

Mr. Ropella discussed how and what adhesives are being used in the plywood door industry. He listed the different types of adhesives used for interior and exterior bonding. Mr. Ropella stressed that in adhesive formulation viscosity is critical and that the correct formulation should be used on the correct product.

Mr. Rhude explained that the correct adhesive for structural glued laminated timber is one that maintains an adequate bond between the laminations for the conditions of exposure to which the joint will be subjected. The end use of the product is often the controlling factor when choosing this adhesive, he stated. He then discussed wood equilibrium moisture content as influenced by temperature and relative humidity, and the two groups into which adhesives for wood are commonly divided, natural and synthetic.

Adhesives in Housing

Mr. Sheppard told about the growing use of adhesives in the housing industry and the particular problems and developments made by National Homes. He explained that by using adhesives we are approaching an ultimate solution to the problem of applying finish materials to framing with expected benefits in labor savings, such as the elimination of dimpling, complete freedom from nail popping, and ultimately in the much greater benefits of being able to produce a completely prefinished panel.

Mr. Maxwell pointed out the methods and processes for making particle board with adhesives used as a binder. He discussed what properties to look for in the adhesive used, such as simplicity, adhesives that do not require catalysts, no pre-cure, adhesives that provide interior strength, and no viscosity build-up.

Mr. Smith cited that over three billion pounds of paper and paperboard were consumed in 1958, and that $150 million worth of adhesives were used by the packaging industry. He then showed over two dozen specimens of paper products that use

The speakers at the symposium on Industrial Adhesives Application, which was held on October 1-2 at the University of Wisconsin, Madison, Wisc. Front row: left to right, John W. Maxwell (Borden Chemical Co.); Clayton O. Stevens (Kawneer Co.); A. J. Slosser (Armstrong Cork Co.); Leonard A. Ropella (Roddis Plywood); and Dr. Don Brouse (U.S. Forest Products Laboratory). Back row: left to right, Isaac Sheppard, Jr. (National Homes Corp.); George W. Crain (Minnesota Mining & Mfg. Co.); Robert E. Zins (Rubber & Asbestos Corp.); Richard F. Blomquist (U.S. Forest Products Laboratory); and Maurice J. Rhude (Unit Structures, Inc.). Speakers not in the photograph are Richard E. Smith (H. B. Fuller Co.) and Charles Latimer (Nickey Brothers, Inc.).

adhesives in their seam and bottom construction.

A panel discussion followed the talks, featuring the five speakers who answered questions from the floor.

Robert Stedfield (*Machine Design*) presided over the second day's session. Two speakers discussed the subject of "Adhesive Fabrication of Metals and Plastics." Robert E. Zins (Rubber & Asbestos Corp.) spoke on the adhesive producers' viewpoint, and Clayton O. Stevens (Kawneer) spoke on the adhesive users' problems. Mr. Zins discussed the aspects of metal bonding; the types of adhesives used for bonding expanded polystyrenes and vinyl films to various surfaces; the materials and adhesives used in curtain wall panel fabrication; the proper utilization of adhesives; and an evaluation of customers' adhesive problems.

Mr. Stevens talked about those products produced by his company which utilize organic adhesives in their fabrication. He told about the laboratory tests that were conducted before an adhesive was used, and pointed out that the biggest problem encountered with the phenyl resorcinol formaldehyde resin adhesive used in the fabrication of the first sandwich type flush door was the handling of the adhesive. He explained that at present Kawneer is gradually changing over to a resin modified neoprene adhesive and that new products are in the design stage which will put more emphasis on the adhesive.

Mr. Zins and Mr. Stevens then conducted a panel discussion on adhesive fabrication of metals and plastics, with Mr. Stedfield moderating.

Quality Control

The next speaker was Charles Latimer (Nickey Bros.) who spoke on "Quality Control Problems in Adhesive Bonding." He explained that quality control is essential because management wants to make its hardwood product as tough as possible. He stated that there are four ways to exercise quality control with adhesives: find out what the competition is doing; follow the adhesive supplier's advice; follow independent advice; and the best way, figure it out for yourself. Mr. Latimer explained that the basic problems to consider in adhesive quality control are: the nature of the surface to be bonded; the nature of the adhesive itself; time/temperature conditions before, during and after bonding; and indirect effects on all materials.

George W. Crain (Minnesota Mining & Mfg. Co.) was the next speaker on the program. He discussed "The Future for Future Adhesives." Prior to talking about things to come, Mr. Crain reviewed what is presently available in the field of elastomeric adhesives; the forms they take; the variety of strengths available; and some of the multiple functions they can be made to serve. In discussing the future uses for adhesives, Mr. Crain mentioned the growing possibilities in the automobile, transportation, appliance, textile, construction, plumbing, and aircraft, missiles and rockets industries. He pointed out that probably the most important people involved with the future of adhesives are the designers and design engineers in industries across the country.

"New Glued Wood Products" was the subject of the talk presented by Dr. Don Brouse (U.S. Forest Products Laboratory), the final speaker at the symposium. Dr. Brouse stated that the use of adhesives in the production of items of wood or of wood in combination with other materials may be expected to keep increasing for an indefinite period. He explained that the gradual decrease in our supply of large saw timbers will result in the use of smaller stock glued to form items of the size and shape desired. Dr. Brouse pointed out that closer utilization of parts of the wood supply now wasted is becoming more important as illustrated by the very marked increase in the production of particle boards. Advances in adhesive formulation now permit fabrication of items of wood in combination with other materials such as metals and plastics, he stated.

A round table discussion on "Trouble Shooting Adhesive Bonds" closed out the two-day symposium. During this group discussion, the previous speakers acted as a brain trust, answering questions concerning the conferees' specific problems.

Joins Borden Chemical

Thomas P. Fitzpatrick has been appointed Midwest district sales manager for the Coatings and Adhesives Department of the Borden Chemical Co., New York, N. Y. In addition to his new duties as sales manager, Mr. Fitzpatrick will be responsible for the operation of the company's Chicago plant until later this year, when those facilities are moved to Illiopolis, Ill. He was formerly technical director of the J. W. Mortell Co. He received a B. S. degree in chemical engineering from Villanova in 1935 and completed graduate work at the University of Louisville, Franklin & Marshall and Illinois Institute of Technology.

"Be not the first
by whom the new are tried,
Nor yet the last
to lay the old aside."

We agree with Alec Pope that one shouldn't be over-impressed with new ideas...nor vainly wedded to old ones. Naturally, being in the Glue business, we apply this thinking to Animal Glue and the so-called "modern adhesives".

We try all new adhesives in our laboratories with the same standard tests and under the same conditions as those with which we test our own Animal Glue. Many of the new adhesives are truly wonderful, but like other tools of industry, they have limitations. In our biased opinion, you still can't beat Animal Glue for many purposes.

Consider its uses: Sizing for rayon fibers, in paper finishing, in match heads, in sandpaper and gummed tape, as a protective colloid in refining uranium ores and in electrolytic copper refining . . . and in just plain sticking things together!

Consider its properties: Flexible in strength...for joining a heavy chair or lining a jewel box with satin. Flexible in setting...slowly for that heavy chair or fast as need be for any type of automatic operation. And flexible in viscosity and pH to adapt to any product or process. Finally...lowest in cost per unit of adhered surface!

Have you *tried* Animal Glue?

Stauffer CHEMICALS SINCE 1885

STAUFFER CHEMICAL COMPANY

380 Madison Avenue, New York 17, New York

Consolidated Chemical Industries Division

P. O. Box 318

Woburn, Massachusetts

San Francisco • Chicago • Houston

Paul W. Mitchell has joined Mobay Chemical as manager of technical service for Merlon polycarbonate resins.

R. J. Seffl, previously with Titan Chemical, has joined the Chemical Division at Minnesota Mining & Mfg. Co.

Arnold O. Beckman, president of Beckman Instruments, has been named to receive a lifetime honorary membership in the Instrument Society of America.

Raymond M. Burke has joined the Market Development Department of Heyden Newport Chemical.

Rollin H. Cragg has been appointed chief of the Chemical Division at the United States Tariff Commission, succeeding the late **Dr. James H. Hibben. Frank Gonet** succeeds Mr. Cragg as assistant chief.

Ruth M. Grennen, Stuart D. Siegell and **Joel J. Kirschbaum** have joined the technical staff at Schwarz Laboratories.

J. Larcom Ober, retired vice-president of Scott Paper Co., has been re-elected president of the University of Maine Pulp and Paper Foundation.

Dr. Edward T. Severs and **Edwin M. Irish, Jr.** have been appointed product managers at AviSun Corp.

Daniel J. Gowman has been named assistant vice-president of Sartomer Resins, Inc. **John A. Cornell,** formerly with H. D. Justi & Sons, has been named director of research at Sartomer.

James E. McCauley has been appointed vice-president of Orangeburg Mfg. Co., a division of Flintkote Co.

Harriet Raymond, advertising manager of the Plastics Division of Celanese Corp. of America, has been named Advertising Woman of the Year by the Council on Women's Advertising Clubs of the Advertising Federation of America.

Reginald C. Whitson has been appointed technical director of Fome-Cor Corp.

Charles A. Godsell has been named eastern regional manager for Shawinigan Resins Corp.

Dr. Brage Golding, director of research for the Lilly Varnish Co., has been named head of the School of Chemical Engineering at Purdue University.

F. L. LaQue, vice-president and manager of the Development and Research Division of International Nickel Co., has been elected president of the American Society for Testing Materials.

Leo H. Schoenhofen, senior vice-president of the Folding Carton and Boxboard Division of Container Corp. of America, has been assigned to take charge of the firm's Container Division, succeeding **Donald H. Brewer,** who has resigned as senior vice-president in charge of the Container Division.

Renata Martin has joined the staff at the New York State College of Forestry as assistant professor of pulp and paper technology.

Arthur Z. Dreis, formerly with Armour Research Foundation, has become a partner in A. G. Dreis & Associates.

J. Alfred Hall has retired as director of U. S. Forest Products Laboratory. He has been succeeded by **Edward G. Locke,** formerly chief of the Division of Wood Chemistry of the Forest Products Laboratory.

W. E. Welliver and **Thomas C. Morganstern** have been appointed regional technical sales representatives to the paper industry for Minerals & Chemicals Corp. of America.

William P. Drewry has been appointed assistant to the president of International Molded Plastics, Inc. **Margers J. Grins** has been named assistant to the vice-president of operations at International Molded.

Coated Release Paper

Crocker, Burbank Papers, Inc., Fitchburg, Mass., has begun distribution of a new silicone-coated release paper after two years of development and evaluation. Reported to provide a unique combination of stable aged release, high strength and high heat resistance, the new product, called Stick-Not, is said to meet a wide variety of requirements.

Its primary applications are designed for the pressure-sensitive adhesive field, embracing labels, decals, tapes, floor tiles, wall coverings and shelf linings. The release paper has also been found suitable for packaging sticky products such as asphalt, vulcanized rubber, camelback and hot melts, as well as for carrier sheets with calendered and unvulcanized rubber. It is also suggested for interleaving tape rolls and rubber heels.

The product is being marketed in rolls up to 83 inches wide, in basic weights ranging from 30 to 80 pounds. Several types are being produced to meet special requirements

ACS National Meeting

The American Chemical Society held its 136th National Meeting on September 13 to 18 at Atlantic City, N.J. Over 1,500 reports on chemical progress in many fields were presented at sessions sponsored by 21 scientific and technical divisions of the Society. Included in the sessions sponsored by the Division of Paint, Plastics, and Printing Ink Chemistry, ACS, were symposiums on Epoxy Resins and Structural Laminates. Of the 54 papers presented by the division, 26 were devoted to epoxy resins and 7 to structural laminates.

New Research Center

Taylor Fibre Co., Norristown, Penna., has announced that operations have begun at its new research center near Norristown. According to Taylor, the center will be used for basic research in vulcanized fiber and laminated plastics.

Oops!

In the article by Carl A. Dahlquist entitled "An Investigation into the Nature of Tack," ADHESIVES AGE, October 1959, the captions for Figures 2 and 3 were inadvertently switched. The graph on page 27 should be headed, "Figure 3—Modulus and Tack of Viscoelastic Materials," and the graph on page 28 should bear the legend, "Figure 2—Extension of Soft Viscoelastic Material."

Reichhold Conferences

Reichhold Chemicals, Inc., White Plains, N.Y., brought together its key scientists and engineers on September 21 to 23 for two three-day conferences on new developments, corporate aims, standards and mutual problems. In addition to representatives from RCI plants in the United States and Canada, eight Reichhold technical executives from Europe also attended the meetings.

First of the two meetings was the International Annual Research and Development Conference which was held at the Dellwood Country Club, New City, N.Y. The meeting was presided over by Herbert L. Wampner, director of research at RCI, and was the first United States meeting since the establishment of the company's central research set-up. Special technical papers were presented on epoxies, high heat resistance resins, chemicals and newly developed methods of analysis. In addition, there was a general discussion of RCI's patent policies.

Because of the importance of coordination with RCI's Engineering Department, the second conference, a meeting of the firm's top engineers, overlapped the first meeting. Presiding over this meeting was Herbert E. Miegel, RCI vice-president, engineering. A major topic on the agenda was the discussion of the establishment of company-wide engineering standards. Additional subjects covered during the engineering conference were: publication of technical articles; RCI patent policy; cost factors and estimation; engineering for safety; establishment of a company-wide engineering news bulletin; and a specific problem symposium. The conferees were taken on an inspection tour of RCI's Elizabeth, N.J., plant at the conclusion of the conferences.

Named Vice-President

Carl B. Johnson, general manager of Armour Alliance Industries, Alliance, Ohio, has been named a vice-president of Armour & Co., Chicago, Ill. Mr. Johnson will continue in charge of Armour's Alliance operation. Mr. Johnson joined Armour in 1949 as assistant general superintendent of the Armour Auxiliaries and in 1950 was named general superintendent. Early in 1959, he was appointed general manager of Armour Alliance Industries.

Adhesives Service

Resin Consultants & Manufacturing Co., Inc., New York, N.Y., formulators of epoxy resin systems, has announced the availability of a custom formulated epoxy resin adhesive service. According to the company, it is prepared to formulate an epoxy resin adhesive system specifically tailored to meet the requirements of the user. Rather than offer a stock epoxy adhesive system that could only partially meet the various bonding problems encountered, RCM formulates systems to meet specific problems, the company states.

Purchases Company

Atlantic Engraving Corp., West Warwick, R.I., has bought the M & S Roll Engraving Co., East Brookfield, Mass. M & S will operate as a division of Atlantic and Edward Megarry, previously M & S owner, will serve as president of the division. The new division manufactures Microflow applicator rolls for adhesives, color, ink and plastics, as well as embossing rolls. Atlantic Engraving is an engraver of pantograph, mill and photo rolls.

Hundreds of machines available that were designed for special industry applications.

Let us know your problem. We'll be happy to submit recommendation.

If your problem is high speed coating of paint, varnish, glue, latex, etc.— POTDEVIN's sixty years of specialization in coating equipment can quickly help you solve it . . . guaranteeing initial low cost and top efficiency. Illustrated is a topside or underside coating machine for applying resins, varnish, glues, lacquer, etc. to webs or sheets of paper up to 21".

ESTABLISHED IN 1893 POTDEVIN

POTDEVIN MACHINE CO.

297 North Street • Teterboro, N. J.

Designers and manufacturers of equipment for Bag Making, Printing, Coating, Laminating, Gluing and Labeling

SEALANT EQUIPMENT

nozzles, cartridges guns and mixers

Patent No. 2,838,210

Write for Complete Catalogue

SEMCO SALES & SERVICE, INC.

3141 W. Century Blvd., Inglewood, Calif. · ORegon 8-2897

PMMI Exhibit

Packaging Machinery Manufacturers Institute Exhibit, scheduled for November 17 to 20 at the New York Coliseum, New York, N. Y., will feature displays by the National Adhesives Division of the National Starch and Chemical Corp. and the United Shoe Machinery Corp. The National Adhesives Division exhibit will stress latest developments in adhesives for package forming and sealing, high-speed bottle labeling and a new extrusion system which National perfected for use with its granular form hot melts. Rapid, trouble-free bonding of a wide assortment of packaging materials will be a key theme of National's exhibit, with the company's Easi-Clean resin adhesives receiving special attention. National's Chemtite, new chemically modified casein bottle labeling adhesive, will also be featured at the booth.

The United Shoe Machinery booth at the PMMI show will display the firm's Thermogrip adhesives and applicators. The firm will exhibit a new system for multi-wall bag closing using Thermogrip adhesive and newly designed equipment. The equipment includes a device for tape handling and folding. A new multi-pack can cartoning machine will be in operation with the closure made with Thermogrip adhesive. The machine is the Roto-Pak, provided by the New Haven Board and Carton Co. Seven different applicators plus additional models, modified for particular uses, eleven machines in all, will be shown. Also on display will be ten different formulations of Thermogrip adhesives and many accessories to the system such as specialized nozzles and wheels.

Staley Names Seidman

A. E. Staley Manufacturing Co., Decatur, Ill., has appointed Dr. Martin Seidman as process research group leader. Dr. Seidman will direct a chemical group team with an engineering group in developing new processes. The engineering group leader is Dr. James O'Hara. Dr. Seidman is a graduate of Brooklyn College. He formerly was a teaching and research assistant at Oklahoma A&M, where he received his master's degree, and the University of Wisconsin, where he received his doctor's degree. Prior to joining Staley as a process research chemist in 1957, Dr. Seidman was with the Salvo Chemical Corp. and the Visking Corp.

Epoxy Resin Modifier

Terpox viscosity modifier, a new reducing agent for use with epoxy resins, has been introduced in development quantities by Heyden Newport Chemical Corp., New York, N. Y. Terpox viscosity modifier is a liquid oxy derivative of a terpene and is a low viscosity liquid, readily miscible with epoxy resins at room temperature. It is said to be applicable to both amine and anhydride cured epoxy systems; to promote penetration and wetting in the system; and to permit increased filler loading of epoxies for potting, casting, laminating, coating, adhesive formulations, body solders, and concrete patching compounds. One pound samples and further information on Terpox viscosity modifier are available from the company's Market Development Department.

New Unit Planned

Glidden Co., Cleveland, Ohio, plans to construct a $600,000 unit for the production of synthetic resins. The unit, one of four approved by the Glidden board recently, is part of the firm's $2.25 million expansion program. All four facilities are expected to be in full operation by 1961.

ADHAESION

This German language monthly journal reports on scientific and technical matters regarding all kinds of natural and synthetic adhesives, thickening agents, binding and bonding materials.

Subscription price for 1 year:
$10 (U.S. funds) including postage

Free sample copy on request.

Please write to:

HADERT - LEXIKON - VERLAG
Berlin W 30 (Germany)
Martin-Luther-Strasse 88A

* If It's New, It's No Doubt Mystik

NEW! 7000-G TAPE for
Extreme Temperature Range —110° to +550° F.

MYSTIK BRAND FIBERGLAS TAPE
with Silicone Adhesives

A new concept in pressure-sensitive tapes—an essentially inorganic pressure-sensitive tape accepted by the aircraft, electrical and electronics industry.

7000-G has a tightly woven, high-tensile Fiberglas® backing with a pressure-sensitive silicone adhesive. Superior thermal and electrical properties make it ideal for many applications previously not possible for pressure-sensitive tape.

(Conforms to Government Specification MIL-1-19166. Approved as Class H Insulation.)

Write for full information on Mystik Brand 7000-G and the complete Mystik line of high and low temperature tapes using silicones with Mylar®, aluminum, copper, and Teflon.

Mystik Adhesive Products, Inc.
2635 North Kildare Ave.
Chicago 39, Illinois

MYSTIK BRAND TAPES SELF-STIK

PACKAGING • PROTECTIVE COVERING • PRINTABLE • ELECTRICAL TAPES

German Plastics Fair

A large number of international scientists and plastics experts attended the 8th German Plastics Convention in Dusseldorf on October 20-21. Nearly 2,000 participants represented 24 countries from Europe and overseas. Nine lectures dealt with various aspects of the plastics industry, including discussions of steel and nickel forms in the production process, uses of plastics in food packaging and construction, and legal problems related to molds.

Dr. Heinz Peukert of the Technical University in Aachen spoke on the limits of thermoplastic transformation of thermoplastics, such as polyvinyl chloride, polymethacrylate and selected copolymers. He reported the results of investigations into elasticity and transformability of such materials in various thicknesses. The Director of the German Plastics Institute, Dr. Karl-Heinz Hellwege, explained in his address the services provided by the institute's documentation office in Darmstadt. One of these is a literature reporting service dealing specifically with plastics and rubber.

Staged at the same time as the convention was the 3rd International Fair of the Plastics Industry, entitled "Kunststoffe 1959." This exhibition, which ran from October 17 to 25, demonstrated technological applications that have been found for plastics by the 700 exhibitors from 15 countries. Also connected with the convention was a symposium on the aging of plastics, held on October 19.

1960 Coating Conference

Technical Association of the Pulp and Paper Industry, New York, N. Y., has announced that its Eleventh Annual Coating Conference will be held on May 23-25, 1960, at the Edgewater Beach Hotel, Chicago, Ill. The conference, which will be a joint meeting with the Graphic Arts Group, will have as its theme "Coating For Printing." Serving on the conference committee are: *General Chairman,* R. W. Hagemeyer (Wyandotte Chemicals); *Program Chairman,* R. W. Martinek (Kimberly-Clark); *Local Arrangements Chairman,* C. W. Cairns (Dow Chemical); and *Publicity Chairman,* W. E. Welliver, Jr. (Minerals & Chemicals Corp.). Tappi requests that persons interested in presenting a paper at the conference should contact Mr. R. W. Martinek, Kimberly-Clark Corp., Neenah, Wisc.

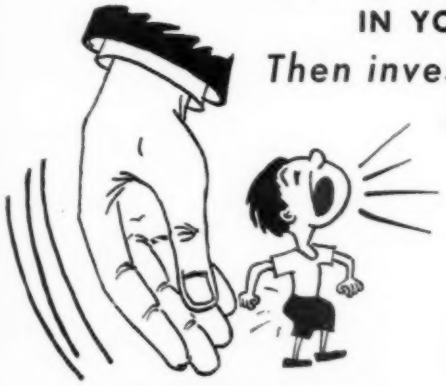
Borrows $8 Million

National Starch and Chemical Corp., New York, N. Y., has completed plans for borrowing $8 million on a 5 per cent note due December 31, 1967. Funds will be used to retire approximately $2 million in short term loans, redeem $1,300,000 of debentures held by an institutional investor, with the balance of about $4,700,000 to be employed in financing current and future expansion projects in both new and existing product lines. The loan was arranged with a group of banks headed by Chase Manhattan and included Morgan Guaranty Trust Co. of New York; Second Bank-State Street Trust Co. of Boston; Central Trust Co. of Cincinnati; and American Fletcher National Bank and Trust Co. of Indianapolis.

New Resins Developed

U. S. Industrial Chemicals Co., New York, N. Y., has developed three new polyethylene paper coating resins which are said to show a marked improvement in adhesion and draw-down characteristics as well as a reduction in neck-in, smoking, coating, temperatures and polymer build-up at the die.

HAVE YOU A "PROBLEM CHILD"
IN YOUR COMPOUNDING DEPARTMENT?
Then investigate these helpful "Factice" facts!

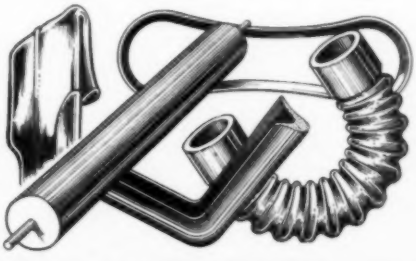


Neophax is

- compatible with Neoprene, synthetics, and crude rubber,
- aids in processing,
- improves extrusion, maintains die size,
- stabilizes mold dimensions,
- permits wide durometer range,
- yields ultimate plasticizing.

FACTICE®
Neophax®

Feel free to submit your problems to us. Just explain your difficulty, or describe the effect you wish to achieve. Without obligation, our laboratory will gladly make helpful recommendations. Data on request any time.



Factice
THE STAMFORD RUBBER SUPPLY CO.
Vulcanized Oil

THE STAMFORD RUBBER SUPPLY CO., STAMFORD, CONN.

patent review

By MELVIN NORD

Adhesive Applicator

U. S. Patent 2,889,922, issued June 9, 1959 to George W. Clarvoe, assigned to Johns-Manville Corp., provides improved means for applying adhesives between overlapping building elements. In Figures 1, 2, and 3, there is shown a device (10) for applying any suitable adhesives, caulking compounds and the like of a character adapting them for cold application. The device (10) is in the form of a container or capsule comprising an envelope or casing (11) formed of a thin, substantially air-tight, but relatively rupturable or frangible material which is resistant to conventional solvents employed as ingredients of the adhesive or other materials to be applied. To meet these requirements the casing may be made from thin films of cellophane, cellulose acetate, plastic ethyl cellulose, plastic Vinylite, rubber and the like.

Fig. 1.

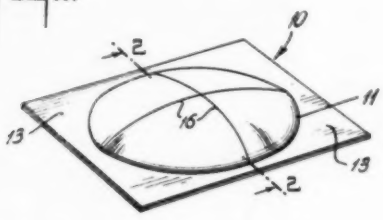


Fig. 2.

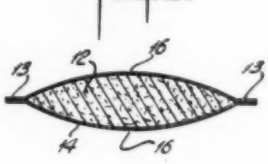
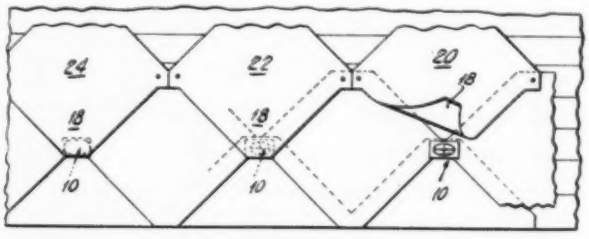


Fig. 3.



The casing encloses a predetermined quantity of the sealing material (12) such as an adhesive or caulking compound of any suitable type. For purposes of example such material, to be used, say, for sealing or adhering the tab of a flexible shingle, may be of putty-like characteristics and consists of approximately 35-50 per cent asphalt having a melt point of 150-160°F., 15-30 per cent of a solvent such as mineral spirits, or petroleum naphtha and 25-40 per cent of fibrous and mineral fiber. To secure acoustical block, the material may comprise natural or artificial gums cutback with suitable solvents.

The casing is formed of overlapped layers of the rupturable films, the overlapped layers being secured together at their marginal portions (13) to define an interior, closed pocket (14) containing the predetermined quantity of the material (12). Where the frangible films comprise cellophane or any of the other thermoplastic materials referred to above, the sealing of the marginal portions is preferably effected by subjecting them to heat and pressure. However they may be cemented, or other means may be employed for joining them. For example, the marginal portions may be wetted with a solvent to partially dissolve the film and render it adhesive, and the marginal portions may then be pressed together to obtain a joining or welding effect.

To insure easy rupture of the casing and to control to an appreciable extent the direction and character of flow of the contained material, the casing may be provided with what may be termed "zones of weakness," which may comprise weakened lines or the like. This weakened zone feature may be obtained, for example, by controlling the adhering of the marginal portions to provide a bond which is weaker than the material of the casing. Alternatively, weakened lines comprising, for example, grooves (16) as indicated in Figures 1 and 2, may be formed in one or both of the overlapping films. The weakened zones may be placed in one portion of the casing, so that the controlled flow of adhesive material may be away from the exposed edge of the overlying building element.

The method of operation with the capsules (10) described above is illustrated in Figure 3 where they are shown as employed for securing the extending tabs (18) of a course of hexagonal shingles to the underlying course in substitution for the means now conventionally employed, such as metal clips, trowel applied adhesives and the like. A capsule (10) is placed on each shingle of an underlying course in position to be overlapped by the tabs of the shingles of the higher course (see shingle 20, Figure 3). The shingle of the higher course is then positioned with its tab overlying the capsule and the tab is pressed down firmly (see shingle 22, Figure 3), causing rupture of the capsule along weakened lines (16), if such are provided, or by separation of the overlapping elements of the capsule at their marginal portions, or in other ways to release the adhesive and cause it to flow between the overlapped portions of the shingles (see shingle 24, Figure 3).

Modified Urea Adhesives

U. S. Patent 2,890,148, issued June 9, 1959 to Joseph B. Dede, Jr., assigned to Monsanto Chemical Co., relates to modified urea-formaldehyde adhesives which are suitable for use in laminating wood or a wood product to itself or to other materials. As an example: A liquid urea-formaldehyde resin containing 65 per cent solids and

NOW ON THE PRESS—

A new fully revised and up-dated edition of

RUBBER TO METAL BONDING

by: S. Buchan

M.A., B.Sc. (Aber.), Ph.D. (Cantab), F.R.I.C., A.I.R.I.

1959, 296 pages, with bibliography

$7.50

This new edition of Dr. Buchan's important and comprehensive work, has been completely revised and up-dated to include the many advances and new developments in the technology of bonding rubber-to-metal in the 10 years since the publication, in 1948, of the widely-acclaimed original edition. Describes processes, applications and methods in detail. Gives concise, straight-forward explanations of how to handle rubber-to-metal bonds at each stage of the job. Sufficient materials are included with each description to permit the reader to project given examples to his own needs. Written by the chief chemist of one of the most successful bonding firms in the world, this is the single most complete source of information about a subject of major technical importance to men working in the rubber adhesive industries.

CONTENTS:

Introduction
Plating Plant
Cleaning Solutions
Brass-Plating Solutions
Methods of Analyses
Electro-Plating
Processing and Process Control
Natural Rubber Compounding
Synthetic Rubber Compounding
Molds and Molding (38)
Physical Examination of Brass Deposits
Chemical Examination of the Rubber-to-Brass Bond
Properties of the Rubber-to-Brass Bond
Bonding Agents, Thermoplastic
Bonding Agents, Halogenated Rubber Derivatives
Bonding Agents, Polyisocyanates
Bonding Agents, Various
Bonding Vulcanized Rubbers
Testing Bonded Units
The Nature of the Rubber-to-Metal Bond
The Importance of Design

DISTRIBUTED EXCLUSIVELY IN THE U.S. AND CANADA BY

PALMERTON PUBLISHING COMPANY,

101 West 31st Street, New York, N. Y.

Use Coupon to order!

Palmerton Publishing Co., Inc.
101 West 31st Street
New York, N. Y.

Gentlemen: Please send ..... copies of Rubber to Metal Bonding when these are available.

☐ check is enclosed ☐ bill me with order

Name .....

Address .....

City ..... Zone.... State .....

having a final formaldehyde to urea mol ratio of 2:1 is prepared. Fifteen parts of pecan shell flour are stirred into 67 parts of the resin, another 33 parts of resin are added to the mix, and 25 parts of a 50 per cent solids latex of an interpolymer of 52 per cent styrene, 6 per cent acrylonitrile, 2 per cent methacrylic acid, and 40 per cent 2-ethyl hexyl acrylate are added with agitation. Ten parts of water and one part of ammonium chloride are incorporated into the mix and stirring is continued until the ingredients are thoroughly blended.

Increasing Adhesive Pot Life

U. S. Patent 2,890,182, issued June 9, 1959 to David P. Langlois and George C. Pinney, assigned to A. E. Staley Manufacturing Co., provides a method of increasing the pot life of the alkaline-curing aldehyde amylaceous adhesives used in the manufacture of laminated and corrugated paperboard, paper bags, and paper tubes. A minor amount of an aldehyde-reactive reagent (e.g. ammonia) is added to the adhesive. This has the desired effect, without adversely affecting the properties of the adhesive.

Double-Coated Tape

U. S. Patent 2,889,038, issued June 2, 1959 to Melvin O. Kalleberg, assigned to Minnesota Mining & Manufacturing Co., relates to double-coated adhesive tape that is normally tacky and pressure-sensitive on both sides and which can be wound directly on itself, without a liner or separator. Use is made of front and back adhesive coatings that are chemically different and physically incompatible. A thin flexible film support is used between the two coatings A number of such combinations of adhesives are disclosed in the patent.

Adhesion Promoter

U. S. Patent 2,888,367, issued May 26, 1959 to William L. Greyson, assigned to Hitemp Wires, Inc. relates to the promotion of adhesion of varnishes, resins, and inks to surfaces such as polyfluoroethylene (e.g. in the case of coated wires). The adhesion promoter is a polymer formed from an alkyl or alkoxyalkyl titanate, incorporating a perfluorinated carbon side chain.

Cold-Water Dispersible Adhesives

U. S. Patent 2,894,895, issued July 14, 1959 to Ernest L. Wimmer and Frank Meindl, assigned to Chas. A. Krause Milling Co., describes a method of manufacturing cold-water dispersible adhesives, for use in gypsum wall board to improve the adhesion of the paper to the core.

The starch is first pregelatinized in the presence of water, and the pregelatinized product is dried. The forces by which starch is tightly bound in the raw granule are loosened by heat and water as the starch swells or gelatinizes. The dried pregelatinized starch product is then acidified and processed under comparatively mild conditions of temperature and holding time. The acidity is then neutralized and the product is used in the production of gypsum wallboard.

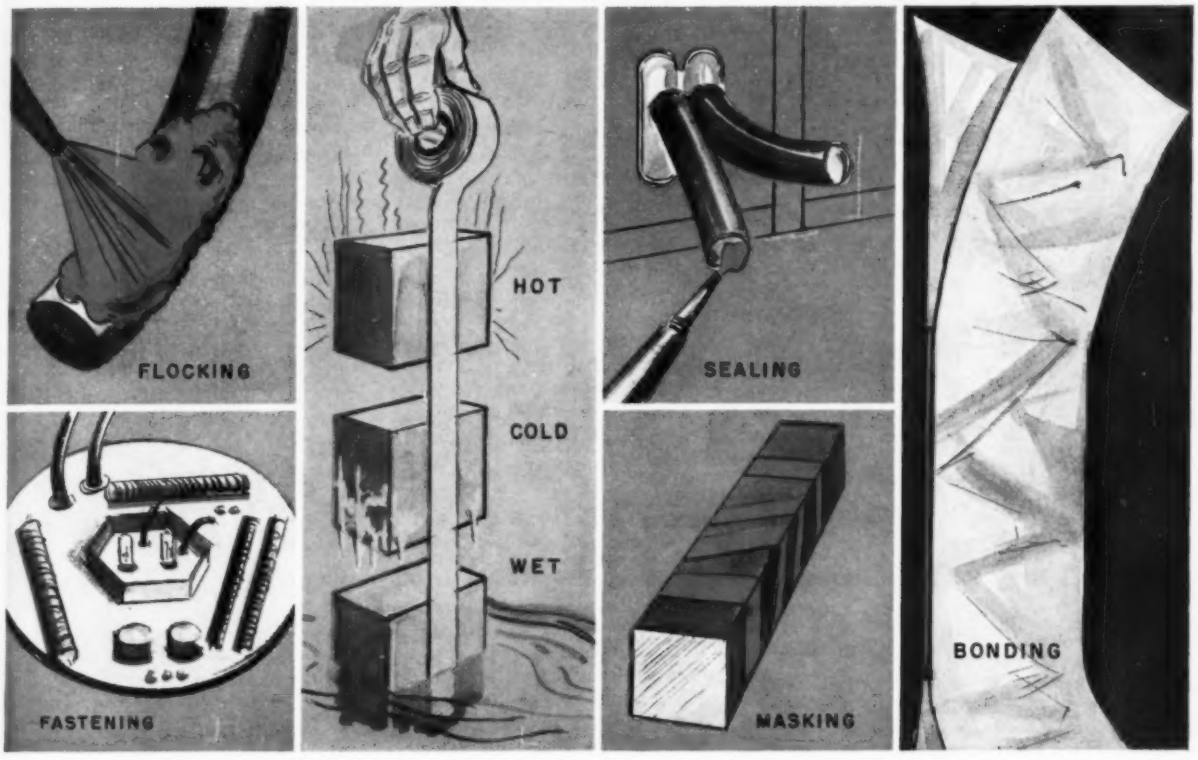
Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Phosphate modified starches	International Minerals & Chemical Corp.	2,884,412	4/28/59
Orthophosphate esters of starch	Corn Products Co.	2,884,413	4/28/59
Delayed tack adhesives	Dow Chemical Co.	2,885,306-7	5/5/59
Adhesive tapes	Johnson & Johnson	2,886,467	5/12/59
Phenol-formaldehyde ketone condensate and starch adhesives	Thomas J. McNaughton et al	2,886,540	5/12/59
Preparation of a dextrin base adhesive	A. E. Staley Mfg. Co.	2,886,541	5/12/59
Aqueous coating composition of coal acids and starch	Dow Chemical Co.	2,887,399	5/19/59
Material for patching plywood sheets	American-Marietta Co., Adhesives, Resin & Chemical Div.	2,888,359	5/26/59
Adhesive bandage	Johnson & Johnson	2,889,039	6/2/59
Dispensers for adhesive tape	John K. Thompson	2,889,146	6/2/59
Polyvinyl acetate adhesive compositions	Atlas Powder Co.	2,889,297	6/2/59
Mastic applicator with removable heads	Robert G. Ames et al	2,889,699	6/9/59
Mastic applicator and corner-finishing tool	Roger G. Ames	2,889,965	6/9/59
Tape dispenser	Johnson & Johnson	2,889,975	6/9/59
Carbonaceous cement	Union Carbide Corp.	2,890,128	6/9/59
Manufacture of cement from calcium sulfate residues	Helmut G. Kaufmann	2,890,129	6/9/59
Tape applicator	Albert Z. Seror	2,890,808	6/16/59
Additive for binding agents hardened by hydration	George R. Underdown et al	2,890,965	6/16/59

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D. C., for 25 cents each. Do not send stamps.

SILICONE NEWS from Dow Corning

Wet, Cold, or Hot, They Stick!



Pressure-Sensitive Silicone Adhesives Offer Unusual Properties

Dow Corning *silicone* adhesives have a special set of properties not common to any other materials. These pressure-sensitive silicones form a good bond with practically anything . . . even wet surfaces, polyethylene, or untreated Teflon. They can be applied, and will stay applied, at temperatures from —80 to 500 F. They are highly resistant to moisture, oxidation, corrosive chemicals, weathering, arcing, corona and fungus. They also have excellent dielectric properties.

Put 'Em on Tape. Dow Corning silicone adhesives form superior pressure sensitive tapes with backing materials almost unlimited. Many tapes utilizing these adhesives are already commercially available; they include backings such as glass cloth, Teflon, Mylar, aluminum foil, Silastic®, the Dow Corning silicone rubber, and combinations of these materials. Supplied by several manufacturers, tapes made with Dow Corning silicone adhesives find a variety of end uses, depending on the backing material. Some of these are: electrical insulation in aircraft, ships, power plants, generators and appliances; bonding, splicing, and sealing; masking in chemical milling; release surfacing; electroplating.

They Stand Alone, Too. As independent adhesives with no backing tape, silicone resins perform a multitude of functions . . . many more are yet to be discovered. A few examples of current applications: fastening electronic components together; coating ductwork in aircraft, in combination with asbestos fibers for thermal insulation; sealing the ends of heating elements in appliances; bonding aluminum foil to itself for use in cryogenic systems; bonding mica and asbestos panelboard; bonding Silastic to the coils of electrical equipment; assembling small aircraft parts or components.

Versatile. As tapes, sealants, spray-on coatings, bonding materials, splicing agents, or in other applications, Dow Corning silicone adhesives show good bond and peel strength, and exceptional resistance to deterioration. If you manufacture adhesives, tapes, sealants, or any product making use of these materials, you should investigate Dow Corning silicone adhesives.

Write today for technical data or assistance. Address Dept. 0123.

Your nearest Dow Corning office is the number one source for information and technical service on silicones.

first in silicones

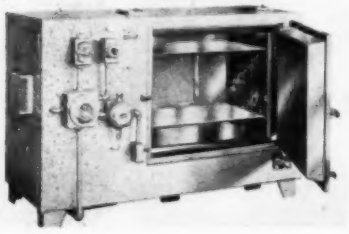
Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

new equipment

Mechanical Convection Oven

Hazard-Safe ovens minimize the danger of sudden internal pressures or sparking, protect the safety of personnel and qualify under insurance regulations. The ovens are designed according to Underwriters' Requirements (Class 1, Group D) for safer heating of alcohols, gasoline, petroleum, naphtha, lacquers, baking enamels, explosives, evaporating sol-



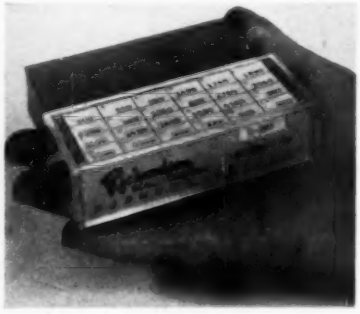
vents and other inflammable materials. The outstanding features of the ovens are explosion-proof ball bearing motor, totally enclosed and fan-cooled; totally enclosed automatic thermostat, pilot lights, contactors, switches, etc., all U.L. approved; explosion-proof release latch; relief panel and cage through rear wall; Modella heater bank operates at "black heat"; sheathed element of low watt density design mounted in an exposion-proof header; all wiring enclosed in vapor-tight, explosion-proof fittings; if door is opened by internal pressures or manually, all electrical circuits are automatically disconnected; excess temperature cut-off included and secondary explosion-proof thermostat provided; motor is interlocked with heater which prevents heater bank operation when motor is off for any reason. The ovens come in bench and floor models. *Blue M Electric Co.* **E-132**

Pressure Mixer

This mixer is designed for blending two or more liquid or viscous materials into one homogeneous mixture without the possibility of air being admitted. Any quantity up to a full quart (Model S-1350) or five quarts (Model S-1378) of material may be mixed in a few minutes and the mix delivered, while still under pressure, into a polyethylene cartridge for use with a sealant gun. Action of the mixer is provided by two double acting air cylinders. The lower cylinder first forces entrapped air through an air bleeder and seal at the top of the container and then holds the container under pressure while the upper cylinder forces a dasher through the material with an involved motion that gives a thorough mix and blend. A counter registers the dasher cycles assuring positive uniformity of batches. *Semco Sales & Services, Inc.* **E-133**

Formula Capsule

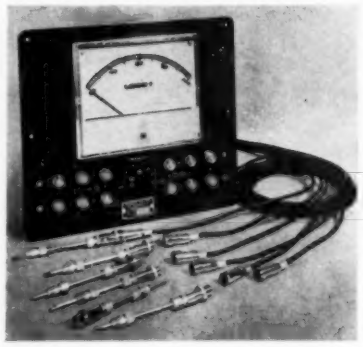
This new Formula Capsule is said to eliminate manual errors in blending, proportioning and batching operations by taking formulation out of the hands of the operator and automatically setting correct proportions of chemicals and similar materials. Integrated with the company's Select-O-Weigh automatic proportioning panel, this pocket size control consists of a network of miniature electronic components



sealed in a shatter-proof protective cover. The capsule is capable of programming the sequence and weighing up to 24 solid and/or liquid ingredients in a single formula. Each ingredient can be pre-set in the laboratory by a simple set screw adjustment on the capsule. This rules out materials waste due to human error and allows precise duplication of the desired formula, batch after batch, the company states. *Richardson Scale Co.* **E-134**

Temperature Indicators

Thermi-Tran Temperature Indicators are designed for use with thermistors, which are thermally sensitive resistors having high negative coefficients of resistance. The high resistance of the thermistors permits the use of ordinary copper wire loads of any practical length with negligible effect on accuracy of meter readings. This accuracy is ±2 per cent of full



scale. Coupled with the proper thermistor probes. Thermi-Trans can be used to measure temperatures of static of dynamic liquids, gases or soft solids as well as surface temperatures of solids. The thermistors respond quickly to temperature changes and readings are practically instantaneous. There are two series of Thermi-Trans available. Series KC-532 is a single channel, portable unit which can be supplied with single or dual temperature range scales. Series KC-871, shown in the photograph, is a panel-mounted, multi-input unit with provision for up to six temperature sensing channels and single or dual temperature ranges. The units can be supplied with meter scales selected from a wide variety of temperature ranges within the limits of the probes to be used. *Kahn and Co.* **E-135**

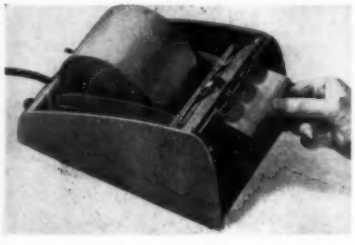
Electric Embosser-Laminator

A complete electrically heated embossing and laminating machine that not only embosses and laminates vinyl coated fabric or unsupported film, but also polishes the materials. The unit, called Electric Embosser-Laminator, consists of a jay-box unwind unit with its own ¾ hp motor; a preheating section with seven 6 inch diameter and one 4 inch diameter double-jacketed electric-type internally heated rolls; full ball bearing embossing nip with a maximum 13 ton pressure; cooling section with

one 10 inch and one 15 inch diameter cooling drum; and a double-chain drive, pressure clutch type rewind section. The machine also has one extra neoprene covered roll 12 inches in diameter with a 62 inch face so that goods up to 58 inches in width can be processed. One 10 inch diameter super finished chromed roller is also supplied. The unit is driven by a 5 hp U.S. Varidyne system and is also supplied with a Dusenbery-type slitter and one three-roll adhesive head. *Liberty Machine Co., Inc.* **E-136**

Label Dispenser

This lightweight manual table model dispenses a full row of labels at one time, and each label is ready for instant use. Designated Model H4-5, it will also handle several individual rolls. It has a capacity to handle rolls ranging from 3/16 inch



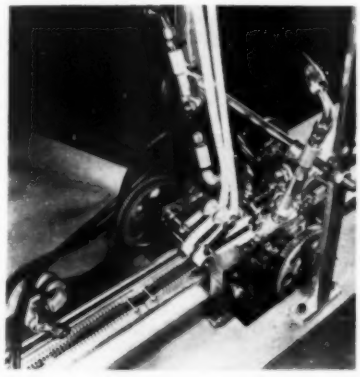
to 5¼ inches wide. Constructed of cast aluminum, the unit weighs five pounds and is 10 inches long, 5 inches high and 6 inches wide. The manufacturer recommends its use where the items to be labeled are within easy reach. *Avery Adhesive Label Corp.* **E-137**

Continuous-Flow Rotor

A continuous-flow rotor that produces foam-free effluent at flow rates up to 600 ml per minute. The rotor develops maximum forces of 28,000 times gravity at 18,750 rpm. It is designed for use with the Spinco Model K high speed preparative centrifuge. Featuring a vertical wall design, the rotor offers maximum efficiency through the combination of high force and 52 square inches of sedimenting area. Freedom from foaming, frothing, and aerosol effect is achieved even at high flow rates, the manufacturer states. The continuous-flow rotor is available with displacement volumes of either 100 or 400 ml. *Beckman Instruments, Inc.* **E-138**

Encapsulating Machine

The unit is a completely automatic machine designed for rapidly applying coating compounds to small articles such as electrical and electronic components. According to the manufacturer, a resinous composition, such as an epoxy compound, can be used to completely form a



light-tight seal on a small part provided the coating material is sprayable. The coating is confined to the desired area by two accurately spaced traveling masking strips, while racks, loaded with the parts, move continuously through the spray station, as shown in the photograph. The parts, while in the moving racks, are spun to assure application of an even coating. *Conforming Matrix Corp.* **E-139**

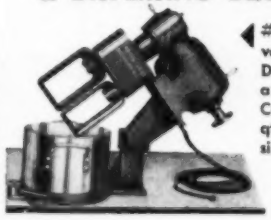
Surface Contact Pyrometer

A self-contained instrument used for quick and accurate measuring of surface temperatures, this unit consists of a hand held temperature indicator and a surface tracer equipped with a thermocouple head. A variety of heads are available in the form of discs, bands, ribbons or nee-

dles. All surface tracers are interchangeable and can be either rigidly or flexibly attached to the indicator. The various standard measuring ranges are available up to 1800°F. The instrument is used for measuring temperatures on all metal surfaces including slowly revolving cylinders or other curved surfaces. *EPIC, Inc.* **E-140**

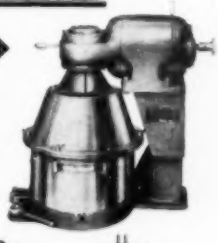
RESEARCH & DEVELOPMENT

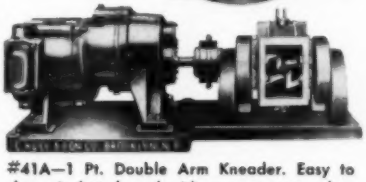
REQUIRES THE BEST MIXING, GRINDING & DISPERSING EQUIPMENT



#130EL—2 gal. variable speed Double Planetary Change Can Mixer—1 qt. — 150 gal. sizes.

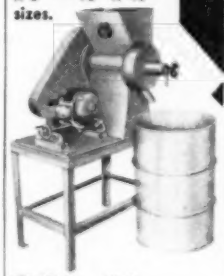
#130EL — 1 gal. vacuum tight Mixer. Available with stainless steel seamless jacketed cans and up to 1 HP exp. prf. motor drive.





#41A—1 Pt. Double Arm Kneader. Easy to clean, jacketed, and with vacuum cover when required. 1 Pt.—150 gal. sizes.

#52LC—4½"x10". Three Roll Mill with water cooled rolls, one point adjustment and quick roll release. 2½" x 5" — 16" x 40" sizes.



#70—H size 4 Dry Grinding Mill Variable speed drive, with 1" feed size ground between ⅛" and #100 mesh as required. Many sizes including other type Disintegrators, Crushers and Pulverizers.

#140DL — High Speed Disperser with specially designed multiple action Millhead. Variable speeds up to 8000 FPM produce tremendous impact, abrasion and hydraulic shear. Laboratory or production sizes.

Write for complete information!

CHAS. ROSS & SON CO., INC.

Leading mfgrs. of wet or dry grinding Mills, Kneaders and Mixers of all types — since 1869.

148-156(A) CLASSON AVE., BROOKLYN 5, N. Y.

book reviews

The Contemporary Curtain Wall: Its Design, Fabrication and Erection. ***By William Dudley Hunt, Jr. Published by F. W. Dodge Corp., 119 West 40th Street, New York 18, N.Y. 7 x 10 in. 454 pp. $12.75.***

This book presents a long needed introduction to one of the most important developments in modern architecture of special interest to the adhesives field: the curtain wall and skeleton system of construction. It is fortunate that this pioneer project was undertaken by a man who is a skillful writer as well as an expert on the subject, having been senior editor of a leading architectural magazine and a practicing architect with design and manufacturing experience in curtain walls. The text he has produced, therefore, forms a useful guide not only for architects, engineers and designers, but also for contractors and manufacturers of construction materials and equipment.

In an introductory chapter, the author explains how this architectural innovation, generally attributed to the Bauhaus school, really constitutes a natural step in the evolution of construction techniques which no longer depend on walls as vertical supporting members. After dealing with the new function of walls as space dividers, he proceeds to outline the advantages and limitations of the many materials that have had their vogue in curtain wall composition. In this, the basic part of the text, he discusses the properties of the various metals, porcelain enamel, glass, plastics, concrete, stone, burned clay, composite panels and organic coatings.

The chapter on composite panels contains a section on adhesives that points out the particular importance of adhesion for laminated panels and outlines the properties of the types most widely used for curtain wall bonding. Aging, tack, shear strength, creep resistance, thermal limits and other data are supplied for phenolics, nitrile rubbers, neoprenes and epoxies. Methods of applying the various plastics and elastomers are also described and illustrated.

A wealth of drawings and photographs serve to underline construction details, especially in the chapter on installation methods. The eight appendices present a list of buildings erected during the past ten years with curtain walls, heat gain and hardness conversion tables, standards and specifications, a comprehensive bibliography, in addition to a roster of associations, societies and government agencies to which the reader is referred to detailed data.

Phenolic Resins. ***By David F. Gould. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y. 5 x 7½ in. 214 pp. $5.75.***

Raw materials, production methods and applications of the phenolic resins are concisely described in this book, the eleventh of a series on plastics applications, which has already presented valuable handbooks on polyethylene and epoxy resins among others. The treatment of phenolics follows the semi-technical pattern of the series, directed not so much at research chemists, as at engineers, designers, architects and management.

The book emphasizes the practical features of phenolic resins, including commercial and economic considerations for such uses as laminates, bonding, coatings, casting and rubber compounding. A special chapter on adhesives discusses advantages of using phenolics, including their remarkable durability, as well as shortcomings such as their relatively short storage life before application. Resin characteristics of phenol and resorcinol glues are summarized handily in tabular form.

Numerous references are made to patents and recent research to supply a forecast of new uses being found for the phenolics. There is also a discussion on the use of phenolics in combination with other resins.

The book includes data and illustrations from most of the major manufacturers in the phenolic field to render an up-to-date account of this "workhorse" among the synthetic plastics which has come a long way since its commercial appearance exactly 50 years ago. Having survived the leveling off in interest that followed their sensational growth period, these resins seem to have entered a steady development phase, helped greatly by the demands of the aircraft and missile programs.

Industrial Gums: Polysaccharides and Their Derivatives. ***Edited by Roy L. Whistler and James N. BeMiller. Published by Academic Press Inc., 111 Fifth Ave., New York 3, N.Y. 6 x 9 in. 766 pp. $25.00.***

Roy L. Whistler, one of the editors of this reference work on polysaccharides and their derivatives, is a Purdue University biochemistry professor who has also co-authored "Polysaccharide Chemistry," a graduate text on carbohydrate gums issued six years ago. In the present volume, he tries to do for the industrialist what he has done for the graduate chemist. He and the 32 industrial specialists who have contributed individual chapters on natural high polymers have succeeded admirably in creating a comprehensive companion volume, which will be constantly consulted by specialists deciding what gum best suits their particular product or application.

The editors have not restricted their search for experts to the domestic industry. Hawaii, Scandinavia, India, Italy and England have been canvassed for specialists on exotic gum products such as tamarind and ti. Since each chapter is provided with its own bibliography, the researcher can, therefore, use the material as a starting point for an international survey of the field.

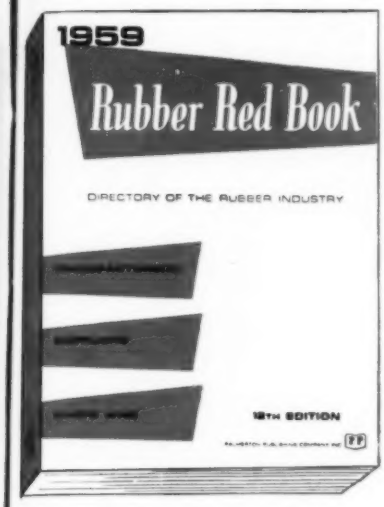
Trade Literature

Potato Starch in the Textile Industry. A four-page bulletin, designed to inform both the chemist and mill man about starch selection and use in non-technical language, gives detailed descriptions of important physical properties of potato starch and relates them to textile processing. In addition, the bulletin contains data on warp size preparation and outlines the advantages of potato starch in warp sizing, thread dressing and fabric finishing. Standards are supplied for high-quality potato starches, including cleanliness, moisture content, ash content and acidity. *Morningstar-Paisley, Inc.* L-137

Fibre Cans and Tubes. This four page pamphlet called "The Profit Makers—Fibre Cans and Tubes" details the versatility and economy of fibre cans and tubes now used in almost all industries. The brochure reports that more than 100,000 different kinds of fibre cans and tubes are now in use in the United States. Included is a report on a survey of 800 manufacturers who are present users of fibre cans and tubes for packaging and shipping containers. *National Fibre Can & Tube Assn.* L-138

Masking Aids. Masking tape discs in sizes from ⅛ inch in diameter up, discs made from special tape for anodized surfaces, heavy cardboard discs for flush masking, taper and self-threading plugs, and very narrow masking tape as small as 1/32 inch wide are among the many masking aids illustrated and described in this M-24 masking brochure. *By-Buk Co.* L-139

Mixing Equipment. Bulletin 591 describes the types of industrial mixing equipment designed and manufactured by the company. Included in the four page bulletin are patented intensive stirrers, vertical mixers, type D mixers and batch type mixers. *Conn & Co.* L-140



THE NEW-IMPROVED RUBBER RED BOOK

The rubber industry's only directory IS READY FOR YOU TO USE

What's new in the rubber industry . . . what kind of products are available . . . where can you get them?

Important facts like these—to help you plot your 1960 production plans . . . to help you buy more effectively, more economically—are all assembled in this single source. And in handier, more useful form than ever before! This is because the RUBBER RED BOOK is now published *annually* . . . redesigned in format, too.

This stepped-up, every-year publication schedule means RUBBER RED BOOK has the latest information available on rubber industry products, plants and people. And its new, larger pages make data easier to find . . . provide more details . . . allow for more useful advertising.

The Encyclopedia of the Industry

Examine this sample of contents for yourself. RUBBER RED BOOK lists each of these items in classified form, along with complete lists of suppliers: rubber products . . . rubber machinery and equipment . . . laboratory and testing equipment . . . accessories and fittings . . . rubber chemicals and compounding materials . . . fabrics and textiles . . . natural rubber and miscellaneous gums . . . synthetic rubber . . . reclaimed rubber . . . scrap rubber and plastics . . . latex and related materials . . . miscellaneous products and services. Plus complete listings of: U.S. and Canadian rubber manufacturers . . . consultants . . . sales offices . . . export agents . . . educational courses in rubber chemistry and technology . . . trade and technical organizations . . . technical journals . . . "Who's Who in the Rubber Industry."

852 Fact-packed Pages **ORDER NOW** **Only $15***

(Coupon)

Published by RUBBER AGE, 101 West 31st Street, New York 1, N. Y.

Please send me ..... copy(ies) of the 1959 RUBBER RED BOOK @ $15* each

☐ **Remittance enclosed**
☐ **Bill me later**

Name .....
Company .....
Street Address .....
City ..... Zone ..... State .....

** Add 3% Sales Tax for each copy sent to New York City addresses*

Facts on Phenolics. A new 16-page reference booklet lists physical properties of 33 phenolic and three diallyl phthalate molding compounds, permitting quick comparison of these compounds in each of the group classifications generally designated by manufacturers. The types thus divided are: general purpose materials with standard, faster cure and special property; improved impact resistant with special property, plus high impact resistant substances; non-bleeding, arc resistant, heat resisting, chemical and moisture resistant materials; and the three diallyl phthalates. Photographs depict examples of products molded from materials of each type. Specifications and standards are indicated. *Hooker Chemical Corp.* **L-141**

HumiSeal Protective Coatings. A chart presents thermal, physical, chemical and and electrical characteristics of protective surface coatings for electronic applications. Ten types of coatings are covered, broken down by the A.I.E.E. thermal classification as well as 47 other specific characteristics for each type. A selector table on the reverse side of the chart enables users to select the type best suited for their purposes according to specific properties desired. *Columbia Technical Corp.* **L-142**

New Gyro-Integrating Mass Flowmeter. This 8-page bulletin describes theory, operation and advantages of an industrial flowmeter that measures flow of fuels, industrial liquids and gases directly in pounds. It includes ranges, specifications, dimensions and cutaway drawings, illustrating principles of operations. Tests are mentioned which have applied components similar to the new instrument to the measurement of aircraft fuels for the past six years. *General Electric.* **L-143**

Weighing Systems. Bulletin 591 covers the company's new Way-Pac 5000 series weighing system. The eight page, two color brochure describes the 5000 pound capacity weighing cells as well as the instrumentation which can be used with them. Five basic types of cells are pictured and diagrammed. Component selection instruction and a summary price sheet are an integral part of the bulletin. *A. H. Emery Co.* **L-144**

Clamps Catalog No. 19. A brief description of a full line of clamps is given in this 32-page catalog, plus a short analysis of the service for which each is recommended. The descriptive material, including a parts breakdown and a list of special features, is presented in chart form. Complete pricing and ordering information is appended. *Adjustable Clamp Co.* **L-145**

A Functional Guide to AutroniC Control Equipment. A large illustrated chart displaying all major system components is featured in an 8-page bulletin on electronic control for the process and power industries. The chart not only enables readers to see quickly what control instrumentation is available to a given process variable, it also defines the over-all scope of application of this control system. The bulletin also contains brief descriptions of all the system components employed and supplies specification bulletin numbers for readers desiring more detailed technical data on any part. *Swartwout Co.* **L-146**

How to Use HumiSeal Protective Surface Coatings in Electronic Applications. A 20-page booklet covers such practical phases of applying humidity-proof protective surface coatings as conventional dipping procedures and steps necessary for dipping, draining, air-drying and curing. It also deals with vacuum impregnation, spray coating and masking, silk screen coating, roller coating and seven other subjects. Six typical examples of spraying procedures are given in step-by-step descriptions of each operation. Informative charts and slide rule settings are included. *Columbia Technical Corp.* **L-147**

Laminating Metal Foil. A two-page technical bulletin describes the principal adhesive properties of sodium silicates and their use in laminating aluminum and other metal foil surfaces. Tackiness, spread, temperature and adhesive concentration are discussed. Advantages cited for silicates are that as mineral adhesives they are odorless, non-poisonous, fire-resistant, non-corrosive to soft metals, and resistant to vermin, rodents and mold. A schematic diagram shows the position of infrared lights used to dry the bond. *Philadelphia Quartz Co.* **L-148**

Electric Process Heaters. The complete line of Chromalox electric process heaters and their uses are described in a new 64 page catalog. Over 15,000 types of heaters to fit most heating needs are included in this catalog. Also included are an application section and a technical section to aid in accurate calculation of heating requirements. Products are illustrated and described with lists of types, sizes and ratings. *Edwin L. Wiegand Co.* **L-149**

FOR MORE INFORMATION on the trade literature reviewed here, use the Reader's Service Card elsewhere in this issue.

Durable, Versatile, Universal Particle Board. A detailed review of the major factors to be considered in the manufacture of high-quality particle board is encompassed in a 107-page technical service report. The comprehensive presentation compiles a great deal of laboratory data obtained in recent years. Three categories of operating conditions prevailing in the use of phenolic binders are presented, as well as material on resin costs, board application, and handling and storage of phenolic resins. An extensive appendix includes resin data, testing methods, suggestions for termite protection of particle board and statistical methods for evolutionary operation. *Monsanto Chemical Co.* **L-150**

Patents and Inventions—An Information Aid for Inventors. The latest Patent Office pamphlet has been prepared for use by those who are approached daily with questions concerning patents, as well as for the benefit of independent inventors and others. The 26-page guide contains essential information on patenting and patent procedures, and related information which may help inventors in the development and marketing of their inventions. It contains a series of six basic steps to be followed in a patent application. *U.S. Department of Commerce.* **L-151**

Dicyclopentadiene Dioxide. Dicyclopentadiene dioxide, a difunctional epoxide that can be used both as a modifier of conventional epoxy resins and as a unique primary building block for an epoxy resin system, is described in a three page booklet. Included are the uses of this reactive diepoxide in alkyd resins, as a plasticizer, and as an intermediate for producing protective coatings, surface active agents, pharmaceuticals and pesticides. *Food Machinery and Chemical Corp.* **L-152**

Armour Aliphatic Organic Chemicals. A complete line of aliphatic organic chemicals is covered in a new 10-page catalog. The publication lists specifications and chemical composition of long and short chain saturated fatty acids, oleic and unsaturated fatty acids, and gives typical applications for each product. In addition, the chemical and physical properties of over 150 fatty acid derivatives are listed. *Armour Industrial Chemical Co.* **L-153**

Cleaning Industrial Floors. How to clean and care for industrial floors is the subject of a new bulletin. All types of floors in various kinds of industrial installations are studied and information presented on their soil removal problems. Methods of sanitizing, stripping old paint and wax, and of absorbing liquids are also discussed. *Oakite Products, Inc.* **L-154**

CLASSIFIED ADVERTISING

Rates: All Classifications except Positions Wanted:

Undisplayed, per inch or fraction .$20.00

Boxed, per inch or fraction.....$25.00

(Approximately 60 words per inch unboxed; 50 boxed. Count 5 words for box number address.)

Positions Wanted:

Set solid, no separate headings or boxes ..... $2.50 for 25 words or less; extra words, 10¢ each. Count 5 words for box number address.

Replies will be forwarded via ordinary mail without charge.

Note: Cash must accompany order.

HELP WANTED

LATEX CHEMIST

5 or more years experience in latex compounding or with latex or resin based adhesives. Technical service and product development work with expanding medium-sized N.J. chemical company.
Excellent compensation and fringe benefits. Send detailed resume and salary requirements. Replies held in confidence. Address Box A-125-W, ADHESIVES AGE.

Chemist experienced in the formulation of adhesives and coatings, particularly epoxy based coatings and encapsulating compounds. Progressive Los Angeles Chemical Company. Top Salary and profit sharing. Write full resume to Box A-126-W, ADHESIVES AGE.

PACKAGING ADHESIVES

Major multi-plant chemical firm desires young experienced salesman for metropolitan area. Growth opportunity with rapidly expanding concern. Experience in allied lines will be considered. Submit preliminary resume. Address Box A-128-W, ADHESIVES AGE.

SALESMAN

Salesfan with experience in selling industrial adhesives. Great Lakes state area. Our line comprises solvent and latex types of natural and synthetic rubbers, vinyl, acrylic and phenolic resin emulsions, solutions and extenders. Plant location in midwest. For further details address Box A-129-W, ADHESIVES AGE.

ADHESIVE CHEMIST

Production minded chemist for expanding plant, specializing in pressure sensitive coating and located in New England. Must be capable of responsible management and enjoy the problems of growth. Salary open, commensurate with background and experience. Please send complete resume and salary requirements, preferably with photograph. Address Box A-130-W, ADHESIVES AGE.

ADHESIVE SALESMAN

Excellent opportunity for experienced adhesive salesman (Ohio). Salary, bonus and expenses. Long-established rubber compounder offers new line of dextrin, resin and latex adhesives. Chance to get in on ground floor. Send brief of experience, education, age and expected salary. Replies confidential. Address Box A-131-W, ADHESIVES AGE.

HELP WANTED-CONTINUED

ADHESIVE CHEMIST

Nationally known adhesive company located in Northern Ohio has opening for experienced research and development chemist. Knowledge of synthetic and reclaim rubber-resin adhesives essential. Experience in epoxies, latex formulations and other structural adhesives desirable. Send complete resume. All replies strictly confidential. Salary open. Address Box A-132-W, ADHESIVES AGE.

CHEMIST OR FORMULATOR OF STRUCTURAL ADHESIVES

Responsibilities—to plan, supervise and carry out assignments in the development and testing of structural adhesives based on resins and rubbers for the practical industrial assembly of dissimilar structural materials, to originate ideas and solutions to problems arising from field contacts.

Qualifications—Degree in polymer chemistry preferred and a practical formulating experience in epoxies, phenolics, polyesters, isocyanates, rubbers, etc.

Location—Northeastern Ohio.

Benefits—Above average programs now in effect.

Salary—Dependent upon qualifications, up to $8,500. Replies to include complete personal history, academic background, industrial experiences, positions, and responsibilities, motivation for changes, salaries, references and avocations.

CHAMBERLAIN LABORATORIES
P.O. Box 624, Stow, Ohio
Attention: Director

EQUIPMENT FOR SALE

$3,000,000 LIQUIDATION CHEMICAL PLANT AT ORANGE, TEXAS. Type 316 Stainless Steel Tanks, Kettles, Heat Exchangers, Columns, Stills, Crystallizers, Centrifugals, Pumps, Valves etc. WONDERFUL VALUES. SEND FOR LIST. PERRY EQUIPMENT CORP., 1414 N. 6th St., Philadelphia 22, Penna.

BUSINESS OPPORTUNITIES

WANTED—Raw Materials, Chemicals, Colors, Plasticizers, Resins, Glues, Gums, Waxes, Solvents. Residues, By-Products. CHEMICAL SERVICE CORP., 82 Beaver St., New York 5, N.Y.

An important British company specializing in the manufacture of Industrial Adhesives, whose products are known throughout the world by their trademark, and who are accepted as beng leaders in their particular sphere, are desirous of contacting a company manufacturing similar products in the U.S.A. with a view to pooling their experience, research and development resources to mutual advantage in both countries. Address Box A-127-B, ADHESIVES AGE.

LABEL ADHESIVE

A quick drying Label Cement. It's waterproof, weatherproof, oil proof, brine proof and it is as transparent as glass. Meets U.S. Army Ordnance Spec. AXS-1472—types 1-2-3 and 4. $2.00 per gal. in 5-gal. cans, F.O.B. Rockford, Ill.
Subject to prior sale
General Cement Mfg. Co., 400 South Wyman St., Rockford, Ill.

ADVERTISERS' INDEX

ADHESIVES AGE—NOVEMBER, 1959

Adhaesion	55
Adhesives Age	44-45
American Latex Products Corp.	3
Colton Chemical Co.	12
Darling & Co., Glue Div.	5
Dow Corning Corp.	59
duPont de Nemours, E. I. & Co., Inc.	15
Dural Co., Inc.	8
Enjay Co., Inc.	Cover 4
Fox, John P., Co., Inc.	8
Goodrich, B. F., Chemical Co.	49
Goodyear Tire & Rubber Co.	9
Hercules Powder Co.	17
International Flavors & Fragrances, Inc. Division of Van Ameringen-Haebler	47
Minnesota Mining & Manufacturing Co.	6
Mystik Adhesive Products, Inc.	55
Patdevin Machine Co.	4, 53
Roberts Co.	Cover 2
Ross, Charles & Son Co., Inc.	61
Rubber Red Book	63
Rubber to Metal Bonding	57
Schenectady Varnish Co., Inc.	19
Semco Sales & Service, Inc.	53
Shawinigan Resins Corp.	Cover 3
A. E. Staley Mfg. Co.	11
Stamford Rubber Supply Co.	51
Stauffer Chemical Co.	21

ADVERTISING SALES STAFF

Advertising Sales Manager
CHARLES T. JANSEN

Advertising Representatives

GERALD F. WALTHEW
101 West 31st St.
New York 1, N .Y.
Phone: Pennsylvania 6-6872

F. ROYAL CAREY
68 Shenandoah Road
Warwick, R. I.
Phone: Turner 4-9624

JIM SUMMERS & ASSOC.
35 East Wacker Drive
Chicago 1, Ill.
Phone: Andover 3-1154

CHRIS DUNKLE & ASSOC.
740 South Western Ave.
Los Angeles 5, Calif.
Phone: Dunkirk 7-6149

420 Market St.
San Francisco 11, Calif.
Phone: Sutter 1-8854

B. G. EDSTROM
15605 Madison Ave.
Cleveland 7, Ohio
Phone: Lakewood 1-7900

in passing

Plus Value of Advertising

Charles G. Mortimer, president of the General Foods Corp., which spent $96 million during the year ended March 31 to advertise its products, thinks advertising not only makes people want, it "helps them get." "Advertising pays," he states, "by developing such a large and dependable volume of sales that we can keep our plants running at high efficiency. But we cannot earn these benefits for ourselves without first benefitting the consumer. This we do by holding down the price of our products, often while improving their quality and utility. Advertising helps make possible lower unit costs through high volume created by increased demand."

Racketeering Department

The Tax Research Institute points out that "advance fee" business rackets are spreading. The Federal Trade Commission has issued several complaints, but the sharpsters continue to operate. Here is how it works: A "buyers' bureau," "lenders' service" or some such organization carrying a respectable name sends fast-talking salesmen out to blanket a neighborhood. They offer to help small businessmen find a buyer for the business, negotiate a loan, or float stock. The salesman asks for a "returnable" fee of $100 to $500. This is the last time the customer sees the salesman or hears from the organization. (The contract mentions only a non-returnable "service charge".) If you hear of anyone operating this way in your community, get the organization's name and call your Better Business Bureau.

No Help Please

A University of Michigan Medical Center therapist says handicapped people should not be pushed into work they cannot do, but at the same time warns against overprotecting them. Too much fussing and cautioning can slow down mental and physical adjustment of the handicapped.

Now They Tell Us

A Washington, D.C. cab driver recently had his morning shave interrupted by a traffic policeman. The trouble was that the driver was clipping his beard while driving—with an electric shaver of course. The shaving-while-driving violation brought a charge of "failure to give full time and attention to driving."

Glad to Hear It

A recent survey conducted by the Consumer Package Research Division of Alford Cartons with 100 supermarket managers in the metropolitan New York area reveals that 83 per cent endorse the glue sealed folding carton over other styles.

Personal Income

Personal income, the average income of men and women, did not decline in 1958, even though business did. The proportion of men whose incomes were $5,000 or more increased by 2 per cent to a new record—32 per cent. Median income for all persons with income was $2,474, as against $2,452 in 1957. But people weren't quite so well off as they seemed; prices went up in 1958, too!

Going to the Dogs

Eight scattered residential blocks in West Memphis, Ark., have been turned over to the dogs by postmen who are tired of being bitten, the Associated Press reports. Four postmen have invoked the protection of a federal postal regulation which says they cannot be required to deliver mail where their safety is menaced by dogs.

"Quick, Benwall . . . I think I've come up with something that has a real grip."